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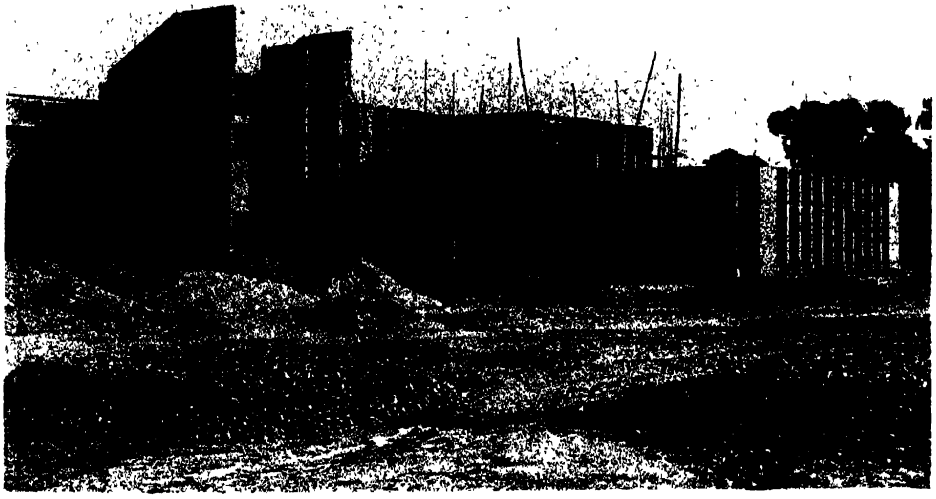

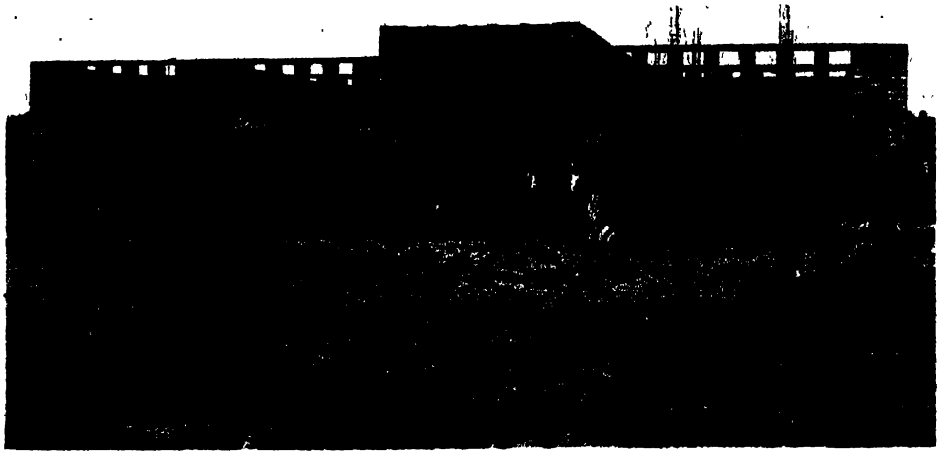

CBRI is the National Nodal Agency for providing S&T back-up for Navodaya Vidyalaya Complexes (p.2). Shown above are such complexes established at Bahraich (U.P.) and Bhucharwada (Diu)

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Design Packages for Navodaya Vidyalaya Complexes: CBRI Contributions

Navodaya Vidyalayas are meant to serve as pacesetters for the talented children from the rural areas who have so far been without access to schools with modern teaching aids and amenities. Under the 'NV Complexes' programme, launched in 1987 at the initiative of the then Prime Minister, more than 400 NV Complexes, one in every district, are proposed to be established.

Realizing the importance of NV Complexes, the Ministry of Human Resource Development looked upon the progamme as a powerful vehicle to propel the whole education process within the framework of the New Education Policy. The real task was, therefore, to have a holistic view from concept to completion, involving formulation of space standards based on the curricula, development of designs suited to different geo-climatic situations, exploitation of local materials and traditional skills, selection of technology options and packages to ensure cost reduction without sacrificing the quality and comfort.

A typical NV Complex includes one school building for 560 students for classes from VI to XII (2 sections of 40 students in each class), multipurpose hall, dormitories, dining and kitchen facilities, teachers' residence and infrastructural facilities including roads, water supply, sanitation and electrification. The total built up area of each NV Complex is of the order of 12,000 m^2 in a land of 8 to 10 ha. Each complex would cost about Rs 25 million and the envisaged cost for the entire project is expected to be more than Rs 10,000 million.

CBRI—National Nodal Agency for NV Complexes

For accomplishing this multi-disciplinary task under a very strict time frame, the Central Building Research Institute (CBRI), Roorkee, was invited to be the National Nodal Agency.

An NV Task Force was created at CBRI in January 1987, for the effective management of the project with the assistance of the institute's six Extension Centres located at Delhi, Calcutta, Hyderabad, Ahmedabad, Bhopal and Trivandrum.

While CBRI provides building designs and complete S&T backup, NV Samiti accords financial approval, and construction agencies execute the building programme. Construction Coordination Committee constituted by NV Samiti, Ministry of Human Resource Development, approves the designs, overviews the project, takes policy decisions regarding cost, phasing and other aspects of the building progamme.

In the first phase of the programme 27 construction agencies are currently engaged in the construction progamme involving 250 NV Complexes in 22 states and union territories.

Climatic Zonation and Technology Options

Climatic classification provides a handy tool to evolve climate based designs. Four major types of climates, viz. hot dry, warm humid, temperate and cold and a subgroup 'composite' were considered relevant. The fundamental assumption was that buildings in each zone ought to possess certain common basic design features. The climatic zoning was superimposed on materials availability, prevalent construction practices and the geology in different parts of the country to further delineate the zoning and develop appropriate design solutions for various zones. For each zone, broad specifications, material components and design parameters were identified. Owing to the vast areas covered by each zone, modification in design parameters, choice of materials for construction and type designs were made to suit the specific location(s).

Space Standards

On the basis of educational needs, curriculum and activity pattern, space requirements for school buildings (class rooms, laboratories, multipurpose hall and other teaching and non teaching spaces), workshop, dormitories, dining/kitchen block principal's residence, teachers' residence were assessed. The space requirements were discussed and finalized in consultation with NV Samiti.

Planning and Design of the Complexes

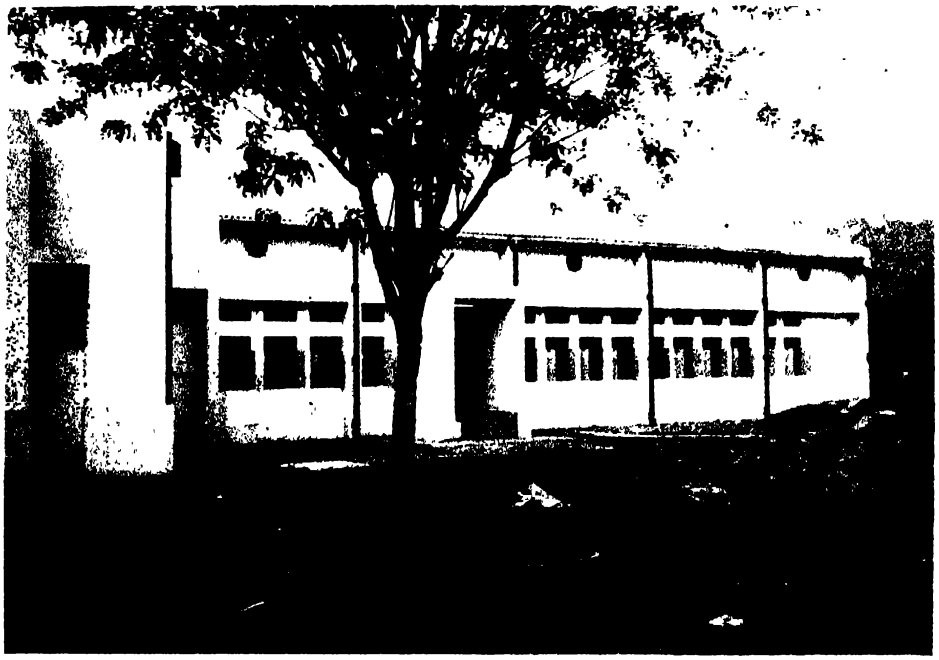
Based on the space norms formulated by CBRI, modular designs have been developed for school buildings and dormitories. The space modules for these buildings have been arrived at keeping in view the horizontal and vertical expansion in phased manner, land configuration, ease in construction and multiple use of the space. Modular designs provide adequate flexibility for planning, designing and construction of building units in instalments. All building spaces have been scientifically designed after studying the activity pattern, number of users and illumination, ventillation and thermal comfort requirements. Multiple use of space has been the prime criterion responsible for provision of optimum spaces avoiding unproductive and wasteful spaces.

The master plans of the campus for different parts of the country have been prepared keeping in view the inter-relationship of various activities, i.e. teaching and non-teaching, optimum movement, topographical, climatological and other location specific considerations. While building blocks have been set apart for the campuses coming in the plains of the northern region, the buildings have been closely spaced and connected

with stairs & corridors in the case of complexes in hilly terrains. Open spaces including play grounds have also been provided.

The bulk services, viz. road network, water supply and sanitation & electrical services have also been designed on the basis of optimal integrated network. It would be possible to provide the bulk services in phases avoiding large capital cost involved in providing bulk services for the entire campus in the beginning. Advantage of the topography and flora and fauna has been taken into consideration while planning and designing of NV Complexes. Landscape and horticulture schemes have been drafted not only to provide appealing aesthetic look but also to keep the students close to nature and to see that they also take advantage of the flora of the site, as far as possible, to meet curriculum requirement wherever feasible.

Stone block masonry casting for Navodaya Vidyalaya building at Jhansi (U.P.)



Multipurpose hall of the Navodaya Vidyalaya at Ernakulam (Kerala)

I. *Exploitation of local materials*

In designing the NV Complexes, as far as possible, use of locally available building materials has been considered. Exploitation of the local materials not only results in reduction in the cost of construction, it also increases employment opportunities for the local people. The use of locally available materials reduces the demand on manufactured materials, their long distance transportation from factory to the site and the cost of construction. Some of the local materials used in the construction of NV Complexes are briefly mentioned below:

(1) Random rubble masonry has been used for walls/foundations in areas where building stones are abundantly available and R R masonry is competitive in cost (for example in Rajasthan, Karnataka, Andhra Pradesh and Kerala).

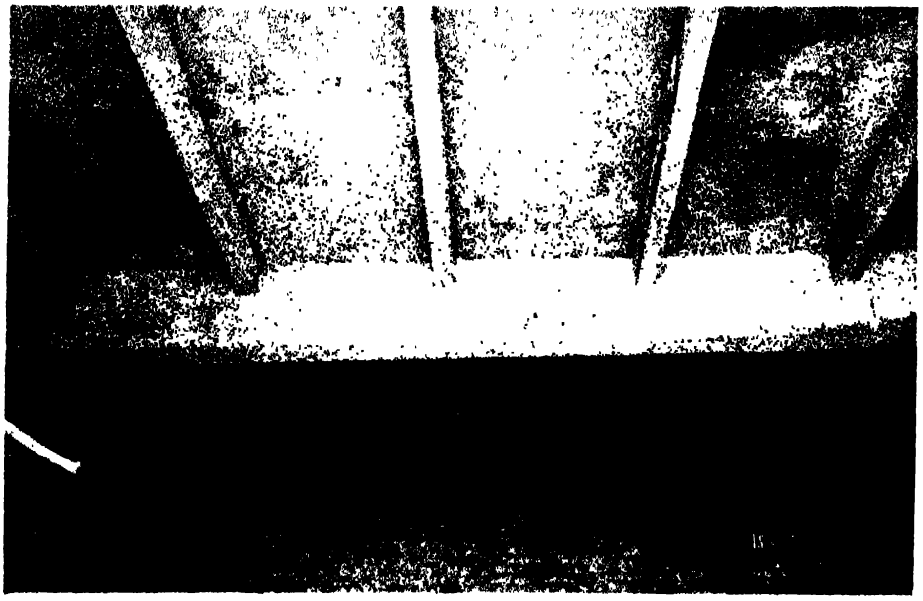
(2) Laterite blocks for walls: Particularly in peninsular India, the walls have been designed to suit the strength and size of laterite blocks which are in abundance in this part of the country.

(3) Coursed masonry with lime stone for schools coming up in Gujarat where stones, locally known as *Bela* stones, are found in plenty.

(4) Stone slabs for flooring: Marble tiles are being used in some complexes in Rajasthan and Cudappah slabs are being used in Andhra Pradesh.

(5) Burnt clay tiles for flooring/terracing: Where such tiles are being produced and the concrete flooring is comparatively costlier, terracing and flooring (except in the laboratories, workshops and dining halls) are being done with burnt clay tiles.

(6) Lime/ALPM for masonry



Ceiling of RC ribbed slab floor, in the Vidyalaya at Sultanpur, U.P.

NV Complex under construction at Faridabad

mortar/plastering: Lime and activated lime pozzolana mixture, wherever available, have been recommended for plain/composite mortar for masonry work and plastering.

(7) Cinder/fly ash for filling in toilets: As these waste products are light in weight, they are ideal for filling the areas around water closets, floor traps, etc. in toilets and bath rooms.

II. *Technologies employed with a view to effecting reduction in construction cost*

Following proven techniques developed at CBRI have been incorporated in the design of NV Complexes for various regions of the country, depending upon the availability of materials, skills, and suitability to the region.

(1) Designed Brick Masonry—Walls account for about 15% of the total cost of a building. The concept of designed brick masonry developed at CBRI and incorporated in the Indian Standards, has been utilized in the design of load bearing walls for the buildings to achieve optimal use of materials. The masonry walls have been designed considering the load, its eccentricity, slenderness ratio of the walls and strength of bricks and mortar.

(2) Precast Stone/Concrete Block Masonry—Precast stone block masonry is being used for the construction of walls of buildings of NV Complexes at some of the sites in Rajasthan, Andhra Pradesh, Maharashtra and Karnataka, as stones are available in abundance in these areas. Precast stone block masonry developed at the institute is an economical alternative to random rubble masonry.

The technique is labour intensive and does not require high capital investment. With exposed stone texture, it gives aesthetically pleasing appearance to the walls. Compared to RR masonry, this technique results in 26% saving in cement consumption, and about 20% saving in the overall cost of walls. The technique is being used for the construction of a number of school complexes in U.P., Andhra Pradesh and Rajasthan.

(3) RC Ribbed Slabs for Floors and Roofs—Compared to conventional RC slabs, use of ribbed slabs results in a saving of about 13% in case of school buildings. RC ribbed slabs are being used in more than 70 NV complexes all over the country.

(4) RC Plank Flooring/Roofing Scheme—With the use of this scheme, a saving of 14% in steel, 27% in concrete and 20% in overall cost can be achieved, compared to *in situ* RC slabs. As the components can be precast and kept ready, the construction time of floor/roof is reduced by about 25%. RC plank scheme has been incorporated in the design of NV complexes in Kerala, Karnataka, etc.

(5) Channel Unit Flooring/ Roofing Scheme—This scheme has all the advantages of precast construction, and compared to coventional construction with *in situ* RC slabs, it results in saving of steel and concrete, elimination of shuttering and about 10% economy. Roofing with channel units has been proposed for NV Complexes in Kerala, Karnataka, etc.

(6) Pile Foundation — Cost effective and well proven foundation technologies of the institute for pile foundation, viz. under-reamed and bored compaction piles, have been adopted for Navodaya Vidyalayas coming up in difficult sub-soil conditions.

Under-reamed piles are bored cast-in-situ concrete piles having one or more bulbs. The presence of bulbs is an important advantage in under-reamed piles for achieving substantial bearing or anchorage. These piles are suited to expansive soils which are often subjected to considerable ground movements owing to seasonal moisture variations, and as also filled up grounds and loose or soft strata. Bored compaction piles are an improved version of normal under-reamed piles in which boring and under-reamed operations are the same as for normal under-reamed piles but the reinforcement cage is driven into the freshly laid concrete, achieving the compaction of the surrounding soil as well as of the concrete, simultaneously. These piles are suitable in loose to medium dense sandy and silty strata particularly with high water table. Both these types of pile foundations are 20-40% economical over conventional foundations. In addition to the under-reamed pile foundations, the apron treatment suggested by the institute for buildings on shallow foundations in expansive soils has also been adopted at a few sites where expansive soil is available only at top layers and provision of pile foundation is not feasible.

(7) Single stack system of plumbing—The conventional method of drainage involves use of two separate pipes, i.e. the soil pipe taking discharge from water closet and urinals and waste pipe taking discharge from baths, sinks and wash basins. In addition, ventilation pipes are fitted with both the stacks. A recent development in this area is single stack system wherein all the appliances are connected to one pipe which itself acts as the ventilation pipe also. An overall saving of 40% is achieved in piping cost compared to the conventional system. Single stack system of plumbing is being adopted in the construction of Navodaya Vidyalayas throughout the country.

(8) Non-Conventional Sources of Energy—The following non-conventional energy sources are being explored to reduce consumption of electrical/mechanical energy: (i) Solar water heating systems, (ii) Solar vertical wall heaters, (iii) Single glazed vented trombe wall, (iv) Roof spray cooling system and (v) Biogas plants using school toilet wastes.

Special Construction for Problematic Sites

NVs in Leh, Lakshadweep Island, remote north-eastern areas are a few examples of problematic sites. Special measures and precautions are being taken to deal with such sites with the objective of converting the site constraints into resources.

Specifications and Cost Economics

Emphasis has been laid on judicious selection of specifications taking into account the cost implication, both in initial and long run expenditure. Application of Life Cycle Cost Analysis technique, a concept of value engineering that takes into account all the recurring costs over the entire productive life of a building at planning stage rather than only the initial cost of construction, has proved to be a useful tool in selection of specifications to effect economy in the long run. Such analyses have been done when more than one alternatives were available for a particular element or component. Life cycle cost analysis of mud thatch roofing and A.C. sheet roofing indicated that the thatch roof, though initially cheaper by about 30% comes out to be costlier by 35% in a life span of 60 years. While choosing the specifications, special attention has been given to conserve scarce building materials. Light gauge CR sheet doors and windows have been specified to minimize the consumption of timber. However, only country wood and secondary species of timber have been specified, for coastal and hilly areas. □

Indo-British Workshops on Heat Pumps and Energy Conservation

Two workshops on Heat Pumps and Energy Conservation were organized under a joint project between the National Chemical Laboratory (NCL), Pune and the University of Salford, UK. The joint project has been sponsored by the British Overseas Development Administration (ODA), and administered by the British Deputy High Commission, British Council Division, Bombay. The first workshop was held on 20 November 1989 in New Delhi and the second one, a three-day workshop, was held during 23-25 November 1989, at NCL.

The four workshops on heat pumps held earlier at NCL, have generated significant industrial interest towards heat pump technology and heat recovery. The aim of the present workshops was to give the participants a realistic appreciation of the availability of international heat pump technology and its relevance to India with a view to promoting the use of heat pumps in Indian industries.

The uncertainty about the future energy supplies has led to an increased interest in heat recovery systems, especially the heat pumps. Heat

Sir David Goodall, British High Commissioner in India, delivering the inaugural address at the Indo-British Workshop on Heat Pumps and Energy Conservation, at New Delhi. Seated on dais (from left) are: Dr V.S. Patwardhan, Prof. F.A. Holland, Mr R. Arbothnott and Dr Ram K. Iyengar

pumps are the only devices for raising the temperature of the low grade waste heat to a higher and more useful level using a relatively small amount of high grade energy. The input of the high grade energy may be either in the form of mechanical energy or relatively high temperature heat energy, depending upon the type of heat pump. In industrially developed countries, many heat pumps of both types, mechanical and absorption, in sizes ranging from kW to MW, are being used resulting in significant energy conservation.

Workshop held in New Delhi

Sir David Goodall, British High Commissioner in India, inaugurated the workshop and Dr Ram K. Iyengar, Additional Secretary, DSIR and Additional Director General, CSIR, presided over the inaugural function. Dr V.S. Patwardhan (NCL) welcomed the gathering and Dr S. Devotta (NCL) proposed the vote of thanks.

Expressing his happiness over the performance of the NCL-Salford collaborative project, Sir David Goodall observed that NCL-Salford link had resulted in some more important and unique programmes between NCL and Indian industries and between Salford and Mexico. He felt that the NCL-Salford project could also serve as a model for other Indo-British collaborations.

Dr Iyengar in his presidential address emphasized the scope of and need for energy conservation in the predominantly agricultural Indian economy in the areas of food processing and transportation. He said that in the rapidly expanding materials science and technology sector such as steel and other metals, ceramics and new polymers, saving of high grade energy would play a very important role. He also described the role of CSIR laboratories in the field of energy conservation in a variety of industrial sectors and the potential impact of these programmes on the economies of these sectors.

Prof. F.A. Holland (University of Salford, UK) briefly outlined the important aspects of NCL-Salford collaboration programme.

After the inaugural function, course lectures were delivered, which covered the following aspects: Heat Pumps: Fundamentals & Economics (Prof. F.A. Holland, University of Salford, UK), Absorption Heating and Cooling (Prof. I.E. Smith, Cranfield Institute of Technology, UK), Heat Pump Compressors (Dr A.V. Heaton, Electricity Council Research Centre, UK), Potential for Heat Pumps (Dr S. Devotta, NCL, Pune), Heat Exchanger Networks (Dr V.S. Patwardhan, NCL, Pune) and Energy Management (Dr D.J. Brown, University of Sheffield, UK).

About forty participants from various industries including chemical and process, metallurgical, distillery, petrochemical, energy, engineering, and consultancy organizations, and various government agencies, attended the workshop. The workshop ended with a lively panel discussion chaired by Prof. Holland.

Workshop held at NCL

Shri R.D. Aga, Chairman & Managing Director, Thermax Ltd, Pune, inaugurated the workshop. In his address, Shri Aga commented that in a country like India, absorption heat pumps are likely to be more useful than compressor driven heat pumps. He asserted that in the Indian context, the industrial applications of heat pumps are going to be more exciting than the space heating applications, and as the energy costs go on escalating, investment in heat pump projects would become more and more attractive even in comparison with other avenues of investment.

Dr R.A. Mashelkar, Director, NCL, in his welcome address stressed the importance of energy conservation in chemical and allied industries in India. The conservation of energy refers not only to the quantity but also to the quality of the energy and a major system approach to planning of energy production and distribution with appropriate packages of incentives and penalties is urgently needed. Dr Mashelkar suggested that a national agency should be made responsible for enforcing energy conservation in all sectors.

Prof. Holland in his introductory remarks highlighted the achievements of the NCL-Salford link and expressed his appreciation for funding by ODA for this project. As a result of the wholehearted cooperation from ODA and many other agencies, this col-

laborative project has been successful in the generation of design data for heat pumps. He added that the heat pump units operated at NCL would be able to convince the Indian industrialists regarding the potential for heat pumps in India.

The following lectures were delivered: Heat Pump Fundamentals and Economics of Heat Pump Applications (Prof. F.A. Holland), Absorption Heat Pumps: Part I & II (Prof. I.E. Smith), Heat Pump Compressors and Heat Pump-assisted Drying (Dr A.V. Heaton), Preliminary Design of Heat Pumps and Heat Pumps & Heat Exchanger Network (Dr V.S. Patwardhan), Organic Rankine Cycle and Absorption Cooling (Mr H. Fernandez, Instituto de Investigaciones Electricas, Mexico), MVR-assisted Evaporation & Distillation and Potential for Heat Pumps in India (Dr S. Devotta) and Industrial Energy Management: Part I & II (Dr D.J. Brown).

The workshop included the demonstration of some heat pumps installed by NCL Heat Pump Group. It also included some video screening on mechanical vapour compression projects in UK, and invited presentation by Thermax Ltd, Pune. The panel discussion was chaired by Prof. F.A. Holland. Dr V.S. Patwardhan delivered the concluding remarks.

The major issues discussed in the workshop pertained to nonavailability of hardware, inadequate fiscal benefits and lack of demonstration project schemes. It was felt that a distinction should be made whether a piece of equipment or hardware is bought for comfort or for energy conservation. In the case of import of hardware for energy conservation, either a lower customs import duty or duty waiver should be granted. As the application of heat pumps in Indian industries would involve some risk in the capital investment, some grants either in the form of risk capital or for joint development and demonstration should be made available to the Indian industries. It was noted that currently there is no such scheme in India.

This workshop was attended by about forty participants from more than thirty organizations. □

CSIR-KVIC Workshop on Selected Food Processing Technologies of CFTRI

CSIR has identified three priority sectors to strengthen the S&T programme of the Khadi and Village Industries Commission (KVIC) to boost the rural economy. These sectors are: food processing, leather technology and building construction. The Central Food Technological Research Institute (CFTRI), Mysore, has been recognized as a nodal agency for providing low-capital, employment-generative and economically-remunerative technologies in the area of food processing.

A five-day CSIR-KVIC Collaborative Orientation Workshop on Selected Food Processing Technologies of CFTRI was organized at CFTRI from 16 to 20 October 1989. Twenty-one KVIC officials from all over the country participated in this lab to land programme on food.

Presiding over the workshop, Shri P. Veerraju, Chairman, Food Engineering Division of CFTRI, said that though the technologies developed by CFTRI are simple, much scientific effort has gone into them right from the conceptual stage through optimization and standardization to commercial production. About KVIC he said that the Commission, rooted in rural and cottage sector, was also encouraging setting up of small and semi-small scale production units which would further activate rural development.

The food processing technologies which were demonstrated by CFTRI to the KVIC officials related to: ready-to-serve fruit beverages, comminuted orange beverage, fruit bars, raisins/dehydration of grapes, instant pickle, malted weaning food, improved method for making *poha*, energy food, mini grain mill, mini wheat mill, simple pulse dehusking, mini rice mill, improved huller, *papad* press, mustard seed hulling, rice bran stabilization, full-fat soya flour, ready mixes, tamarind powder and poultry feed. These technologies would be

Prof. M.G.K. Menon addresses CSIR Directors' Conference

Prof. M.G.K. Menon, Minister of State for Science & Technology, inaugurated the CSIR Directors' Conference, held in New Delhi, during 21-22 December 1989.

In his address, Prof. Menon emphasized that endeavour of the present government is to ensure integration of scientific & technological capabilities with our other efforts for national development. He said that CSIR being the oldest R&D organization with widest range of disciplines under its aegis, is the right organization to play an important role in this regard. Stressing that the Directors must have a vision for what S&T can do for the country, he said that they have to visualize not only in tangible or economic terms but also in intangible terms like rational thinking in education, etc. He clarified that there is a full support for S&T at all political levels irrespective of the political affiliations. The S&T has to deliver the goods and make efforts towards employment generation, and proper utilization of natural resources for the benefit of the masses at grassroot level. It has to live up to the expectations of the Indian society. Instead of compartment-based thinking there should be coordination, linkages and associations at all levels.

Dr A.P. Mitra, Director General, CSIR, welcomed Prof. Menon to the Conference which discussed the vast gamut of scientific activities of CSIR. □

transferred through CSIR and appropriately adopted by KVIC to the rural sector under the overall guidance of CFTRI.

At the round-up session held at the end of the workshop under the Chairmanship of Dr M.M. Ahuja, Director, Science and Technology, KVIC, Bombay, nine technologies out of the 20 demonstrated were selected by the participants as those were readily amenable to rural adoption under KVIC operations. KVIC would convey to CFTRI regarding the suitability of rest of the technologies after consulting respective coordinators who were not present. It was also agreed that the projects based on selected technologies would be implemented within 3-6 months by CFTRI at the appropriate places indicated by KVIC. Project economics would be so designed that every investment of Rs 15,000 in any project will lead to an employment generation for one person.

Shri S.M. Ananthakrishna, Scientist, IDCS, CFTRI, was the Coordinator of the workshop and Dr V.H. Potty, Chairman, Technology Application Division of CFTRI, was the chief architect of this workshop under whose guidance, the entire programme is being implemented as a part of CSIR's Societal commitment. □

NEERI signs MoU with NPC for undertaking EIA Studies of Atomic Power Projects in India

The National Environmental Engineering Research Institute (NEERI), Nagpur, signed a Memorandum of Understanding on 14 December 1989 with the Nuclear Power Corporation (NPC) for undertaking Environmental Impact Assessment (EIA) Studies of Atomic Power Projects in India. The studies to be undertaken by the institute under the MoU will result in the preparation of scientific environmental management plans ensuring compatibility between environment and economics related to atomic power plants.

The R&D work on EIA involves collection of baseline environmental status, identification of potential adverse impacts, prediction of significant impacts with recourse to mathematical and simulation modelling, and evaluation of quantified impacts as a basis for preparation of environmental management plans.

The institute has already completed rapid environmental impact studies for Nuclear Power Corporation projects at Kaiga (Karnataka) and Rawatbhata (Rajasthan). Similar studies are now planned for Narora Power Plant in Uttar Pradesh. The rapid EIA studies spanning 3 months each for these projects will be followed by comprehensive assessments over a timeframe of 12 months. □

Shanti Swarup Bhatnagar Prize for Mathematical Sciences: 1988

Dr M.B. Banerjee, Department of Mathematics, Himachal Pradesh University, Shimla and Dr K.B. Sinha, Indian Statistical Institute, New Delhi, have been chosen for the Shanti Swarup Bhatnagar Prize in the discipline of Mathematical Sciences for 1988.

Dr Banerjee has made important contributions to the mathematical theories of magneto- and thermohaline-convections and Dr Sinha, to the mathematical theory of quantum scattering, spectral theory of Shrödinger operators and quantum stochastic calculus. □

Phytochemical and Pharmacological Studies of *Astragalus polycanthus* and *A. himalayanus*

Shri Rajinder Kumar Gupta while working at the Regional Research Laboratory (RRL), Jammu, studied two *Astragalus* species, viz. *A. polycanthus* Royle and *A. himalayanus* Klotz. The salient findings of the study are:

I. Isolation of new alkaloids—Four new indolizidine alkaloids, i.e. 1,2,5-trihydroxy, 7-methyl-6-phenyl-1, 2, 3, 5, 8, 8a-hexahydroindolizidine; 7-methyl-6-phenyl-5-oxo-1, 2, 3, 8, 8a-pentahydroindolizidine; 6-(4-hydroxy-3-methoxyphenyl)-7-(4-methoxy)- 5-hydroxy, 8a methyl-1, 2, 3, 5, 8 (-)pentahydroindolizidine; 6-(9-isobutylidene-9-hydroxy)-6-methyl (-) 1, 2, 3, 5, 7, 8-hexahydroindolizidine, and a steroidal alkaloid zygadenine 3-O-β-D-glucoside were isolated from *A. polycanthus*. Isolation of new indolizine alkaloids confirms the chemotaxonomical evidence of indolizidine nucleus in the genus *Astragalus* Among the 18,000 species of family Leguminoseae (including about 2000 *Astragalus* species) reported so far, only two indolizidine alkaloids, i.e swainsonine (*A. lentiginosus* and *A emoryanus* and castanospermine (*Castonospermum australe*) have been reported so far. The occurrence of indolizidine nucleus also establishes a structural affinity to pyrrolizidine and quinolizidine alkaloids in the family Leguminoseae The related indolizidine alkaloids reported from plants, animals, insects and fungal metabolites have been of biological interest due to their physiological and anticancer properties. Isolation of zygadenine-3-β-D-glucoside, is the first report of steroidal alkaloid from genus *Astragalus*.

II. *Isolation of known compounds*—The following known compounds were reported for the first time from these two *Astragalus* species: pinitol, kaempferol quercetin, rutin, hextriacontane, tricosanone, triacontanol and β-sitosterol from *A. himalayanus* and nonacosane, hentriacontanone, triacontanol, β-sitosterol and compesterol from *A. polycanthus*.

III. *Pharmacological investigations*—Defatted alcoholic extracts of these plants showed cholinergic effect in *in vivo* and *in vitro* studies. Extract of *A. polycanthus* also showed oes-

trogenic effect.

Shri Gupta worked under the joint supervision of Dr Jagdev Singh of RRL, Jammu and Prof. D.D. Santani of L.M. College of Pharmacy, Ahmedabad and was awarded Ph.D. degree by Hari Singh Gour Vishwavidyalaya, Sagar (M.P), for his thesis based on the above studies.

Intracellular Replication of Choleraphages

Studies initiated at the Indian Institute of Chemical Biology (IICB), Calcutta, on the phage-host interactions in respect of *Vibrio cholerae* have indicated promise of phages being useful for studying this highly pathogenic organism. Recently, Ms Rukhsana Chowdhury of IICB studied the intracellular replication of choleraphages ϕ149 and ϕ138. The phage ϕ149 merits special attention because of its immense taxonomic value. Because of its ability to infect and lyse only the classical vibrios, but not their eltor biotypes, phages ϕ149 can serve to differentiate the two types of vibrios.

It was demonstrated for the first time that the intracellular replication of the circularly permuted DNA of choleraphage ϕ149 involves a concatemeric DNA structure with a size equivalent to six genome length. The syntheses of monomeric and concatemeric DNAs during replication of ϕ149 occur in the cytoplasm. The concatemer serves as the substrate for the synthesis of matured phage DNA which was eventually packaged by a headful mechanism starting from a unique *pac* site in the concatemeric DNA. Packaging of DNA into phage heads involves binding of concatemeric DNA to the cell membrane. A scheme involving sequential packaging of five headfuls proceeding in the counter clockwise direction from the *pac* site was proposed. After infection under high phosphate condition the concatemeric DNA intermediates were not formed although syntheses of monomeric molecules were unaffected.

The researcher demonstrated by thin section electron microscopy, the intracellular development of choleraphage ϕ149 following infection of both classical vibrios and their biotype eltors under different experimental conditions. Degradation of the host DNA following infection and formation of matured phage particles inside infected cells was demonstrated. The concatemeric DNA intermediate formed in the permissive host was resolved in thin section electron micrographs.

Studies were made to identify the step during intracellular replication of ϕ149 which is blocked during injection of *V. eltor* cells. Ms Chowdhury examined the replication of this phage in *V. eltor* cells. She demonstrated that while all the initial events following ϕ149 infection were similar in *V. cholerae* and *V. eltor* cells, the concatemeric DNA intermediates produced in *V. eltor* cells were unstable and could not be chased into matured phage DNA. From pulse labelling experiments of UV irradiated infected cells, the researcher could identify the phage specific proteins made in the nonpermissive *V. eltor* cells. Although most of the early proteins were made, only some late proteins were transiently synthesized.

To investigate whether the circular permutedness of ϕ149 DNA is responsible for nonpermissiveness of *V. eltor* cells to support phage growth, the researcher used the choleraphage ϕ138, the DNA of which is also circularly permuted. She demonstrated that this phage can replicate in both *V. cholerae* and *V. eltor* cells and the concatemeric DNA intermediates are identical in both hosts.

These studies have been very useful in subsequent identification of a gene function in *V. eltor* cells responsible for instability of ϕ149 concatemeric DNA intermediates.

Ms Chowdhury worked under the guidance of Dr Jyotirmoy Das, Deputy Director and Head, Biophysics Division, IICB, and was awarded Ph.D. degree in Biochemistry (1989) by the Calcutta University for her thesis based on these studies. □

Studies on Tubulin-Microtubule System and Colchicine Tubulin Interaction

Dr B. Bhattacharyya's Bhatnagar Prize-winning Work*

Dr B. Bhattacharyya has made outstanding contributions in the Tubulin-Microtubule field. He has been contributing in this field since 1974 and has published 43 papers in international journals. Discovery of colchicine fluorescence upon binding to tubulin by him replaced the cumbersome filter disc assay method using radioactive colchicine and at same time offered determination of binding parameters at the equilibrium conditions. He first established the authenticity of membrane-bound tubulin immunologically and biochemically. Antimitotic drug colchicine is viewed as a potential therapeutic agent against malignant diseases and as a tool for Cell Biologists for studying cytoskeletal structures and cell cycle. On both these accounts, colchicine has the undesirable properties of toxicity, irreversibility and high temperature coefficient of binding. He has undertaken a series of structure-activity studies, synthesizing various analogues of colchicine as well as modifying tubulin structure by chemical modifications and controlled proteolysis. His study has contributed significantly to the recognition of these agents by tubulin at the molecular level on which design of new antimitotic drugs can be based. Recent studies have iden-

*Dr B. Bhattacharyya of the Bose Institute, Calcutta, has been chosen for the 1988 Shanti Swarup Bhatnagar Prize in Biological Sciences (alongwith Prof. M.R.S. Rao of the Indian Institute of Science, Bangalore) [*CSIR News*, 39 (1989), 250].

tified such new antimitotic agents which may have great benefit in clinical management of malignancies.

While studying colchicine fluoresces when bound to tubulin, he observed that the immobilization of the colchicine in an environment of low polarity and a low threshold viscosity, rather than its hydrophobic environment alone might be the basis

for the phenomena. This study has created a new concept of small molecule fluorescence. It has been proposed that immobilization-enhanced fluorescence may be more common than heretofore believed.

Dr Bhattacharyya (born, 2 Dec. 1944), obtained his B.Sc. (Hons) and M.Sc. (Physical Chemistry) in 1965 and 1967, respectively, from the Calcutta University. He obtained his Ph.D. degree from the same university in 1974. He started his career in biochemistry in 1973 as a Fogarty research fellow at the National Institutes of Health, Bethesda, Maryland, USA. He joined the Bose Institute, Calcutta, as Lecturer in 1978 and became Reader in 1982. He has visited several academic institutes abroad, on invitation, and has participated and delivered lectures at various international conferences and symposia. He was awarded P.S. Sarma Memorial Award in 1987 by the Society of Biological Chemists (India). □

CONFERENCE BRIEFS

Indo-French Seminar on Organization and Expression of Plant Genomes

The title seminar was held at the Institute of Plant Molecular Biology, Strasbourg, France, during 5-8 October 1989. Sponsored by IFCPAR, it was the first such seminar in the area of Plant Biology. About 50 scientists, including nine from India, participated. The deliberations included a variety of topics such as: virology and plant pathology (16 talks); genome organization, gene structure, function and expression (15 talks); and nitrogen assimilation and auxin action (7 talks).

Dr Sushil Kumar, Head, Human Resource Development Group, CSIR, presented a talk on 'Definition of new symbiotic genes using phages as markers in *Rhizobium meliloti* (co-author S.P.S. Khanuja, IARI).

Another presentation from CSIR was by Dr P.K. Ranjekar, National Chemical Laboratory, Pune, on 'Novel features of structure and organization of repeated sequences in rice (*Oryza sativa,* cv. Basmati)' (co-authors: Madhu Dhar, Vaijayanti Pethe and Vidya Gupta).

Some of the French participants suggested that the next seminar be held in India. The Indian participants thought it was right time to form Association (or Society) of Plant Molecular Biologists and decided that Dr Sushil Kumar initiate this process by calling a meeting of scientists for this purpose.

While in France, Dr Sushil Kumar also visited the CNRS laboratory Gif-sur-Yvette (Paris) and held discussions with Dr A. Kondorosi.

International Symposium on Application of Biotechnological Methods and Recent Accomplishments of Economic Value in Asia

Dr M.C. Srinivasan, Scientist F, National Chemical Laboratory (NCL), Pune, participated in the title symposium, held at the Chulalongkorn University, Bangkok (5-9 Nov. 1989), on invitation from the organizers, Asian Network for Biological Sciences (ANBS), who sponsored Dr Srinivasan's participation.

The NCL scientist delivered an invited talk entitled 'Biotechnological methods used to enrich and utilize microbial resources in developing countries' at the opening scientific session of the symposium. In this talk he emphasized the need for applying novel methods to identify germplasm resource pools for useful biotechnological applications from the developing world and also illustrated the same with specific examples from the research work being carried out at NCL under the project on Microbial Technology with special reference to strain identification for industrially useful microbial enzymes such as xylanase and alkaline protease.

The papers presented at the symposium referred to a wide variety of biotechnological applications, and covered topics ranging from improvement of crop productivity to biological methods of insect control and waste recycling. Visits were arranged to the biotechnology department of the Chulalongkorn University as well as to an orchid farm where tissue culture techniques are being extensively applied for large scale production of different orchids for export markets as well as for meeting regional demands.

Australian Aeronautical Conference-1989

Dr R. Gopinath of the National Aeronautical Laboratory (NAL), Bangalore, was deputed to attend the title conference held at Melbourne, Australia, during 9-11 October 1989, and present a paper on 'Wall Interference Studies at NAL' at the conference.

During his visit, Dr Gopinath also visited the University of Sydney, and held discussions with Dr C.A.J. Fletcher, Dr K. Srinivas and Prof. Stevens, on topics of common interest.

Honours & Awards

Prof. M.V. George gets Hari Om Ashram Trust Award

Prof. M.V. George, Regional Research Laboratory, Trivandrum,

has been awarded the Hari Om Ashram Trust award carrying a cash prize of Rs 10,000 and a citation.

Dr O.N. Mohanty gets National Metallurgist Day Award

Dr O.N. Mohanty, Head, Material Processing Division, National Metallurgical Laboratory (NML), Jamshedpur, has been awarded the prestigious National Metallurgist Day Award for 1989 by the Ministry of Steel & Mines, Government of India, for his outstanding contributions to the field of phase transformation, thermodynamics and kinetics and X-ray diffractometry. The award is given to six distinguished metallurgists of the nation every year for their contributions to the field of metallurgy.

Shri Samar Das and Dr Rakesh Kumar

Shri Samar Das and Dr Rakesh Kumar of NML, Jamshedpur, were awarded second prize in the 'Electron Microscopy & New Metallographic Techniques' area at the metallographic contest held during the 43rd Annual Technical Meeting of the Indian Institute of Metals.

Shri Kishorilal, Shri R.K. Mahanti and Dr C.S. Sivaramakrishnan

For their poster session paper entitled 'Studies on the microstructures in rapidly solidified Al-6 Fe-3 Misch Metal and Al-6 Mn-3 Misch Metal', the above NML scientists won an award at the Annual Technical Meeting of the Indian Institute of Metals, held on 16-17 November 1989 at Calcutta.

Dr S. Sengupta

Dr S. Sengupta, Scientist EI, Indian Institute of Chemical Biology, Calcutta, has been selected for the Sankar Prasad Ghosh Memorial Award for the year 1989. The award carries a cash prize of Rs 500. Dr Sengupta delivered the S.P. Ghosh Memorial lecture on 'Interlinked regulation of methionine biosynthesis in *E. coli* K12. □

NOMINATIONS INVITED

Shanti Swarup Bhatnagar Prizes in Science and Technology for 1990

Nominations are invited by the Council of Scientific & Industrial Research for the Shanti Swarup Bhatnagar Prizes in science, including engineering and technology, for 1990. The prizes are to be given for research contributions made primarily in India during the past five years. The upper age limit of nominees for the prize is 45 years.

The prizes, each of the value of Rs 50,000, may be awarded annually for notable and outstanding research, applied or fundamental, in the following disciplines: (1) physical sciences, (2) chemical sciences, (3) biological sciences, (4) engineering sciences, (5) medical sciences, (6) mathematical sciences, and (7) earth, atmosphere, ocean and planetary sciences.

Those who can make nominations include: presidents of academies and approved scientific societies of all India character, vice chancellors of universities, deans of science, agriculture, engineering, technology and medical faculties, directors of Indian Institutes of Technology, deans of faculties and heads of institutions deemed to be of university status, director generals of major R&D organizations such as the Defence Research & Development Organisation, Indian Council of Medical Research, Indian Council of Agricultural Research, India Meteorological Department, chairmen of Atomic Energy Commission, Electronics and Space commissions, Oil and Natural Gas Commission, Science Advisory Committee to the Cabinet, etc. directors of CSIR laboratories, Bhabha Atomic Research Centre, Tata Institute of Fundamental Research, Physical Research Laboratory, Indian Association for the Cultivation of Science, etc. and secretaries of the Department of Environment, Department of Science and Technology, Department of Electronics, etc. Member-in-charge of Science (Planning Commission) and the Bhatnagar prize winners. University faculties should recommend persons working in their institutions only and route the nominations through their respective vice-chancellors, while the faculties in IITs should send their nominations through their directors. Directors of CSIR laboratories can nominate candidates in the discipline of their interest, irrespective of whether they are working in CSIR or outside. Each Bhatnagar Prize winner can send the nomination of one person for each year's award in his own discipline only. Each such nomination shall give a detailed statement of work and attainments of the nominee, and a critical assessment report (in not more than 500 words) bringing out the importance of the significant contributions of the nominee made during the past five years. Nominations from individuals sponsoring their own names or of others will not be accepted.

Nominations may be sent by registered (acknowledgement due) post along with 20 copies of detailed statement of work and attainments of each nominee and the discipline under which the nominee is to be considered. The attainments of the nominee during the past five years may be highlighted, and sent alongwith one set of reprints of papers published during the 5 years period. Nominations signed by the sponsors should be sent marked 'confidential' to the Head, Human Resource Development Group, Extramural Research, CSIR Complex, Pusa, New Delhi 110012 by 31 March 1990. Regulations governing the prize and the proforma for nomination may by obtained from the above address. □

PATENTS FILED

900/DEL/89: An improved process for the manufacture of crystalline aluminosilicate ZSM-5, A.N. Kotasthane, V.P. Shiralkar and P. Ratnasamy—National Chemical Laboratory, Pune.

901/DEL/89: A process for the preparation of novel crosslinked macroporous glycidyl copolymers, S. Ponrathnam, C.K.M.R. Rajan, R.A. Mashelkar, K.K. Krishnadas, G.R. Ambekar, S.R. Naik and J.G. Shewale—National Chemical Laboratory, Pune.

902/DEL/89: A process for the production of immobilized penicillin G acylase using novel crosslinked macroporous glycidyl copolymers useful for the preparation of 6-aminopenicillanic acid, S. Ponrathnam, C.K.M.R. Rajan, R.A. Mashelkar, K.K. Krishnadas, G.R. Ambekar, S.R. Naik, J.G. Shewale—National Chemical Laboratory, Pune.

903/DEL/89: An improved process for the production of 6-aminopencillanic acid using penicillin G acylase immobilized on novel crosslinked macroporous glycidyl copolymers, S. Ponrathnam, C.K.M.R. Rajan, R.A. Mashelkar, K.K. Krishnadas, G.R. Ambekar, S.R. Naik, J.G. Shewale—National Chemical Laboratory, Pune.

904/DEL/89: An improved process for the hydrodewaxing of petroleum oils, S. Sivasanker, K.M. Reddy, K.J. Waghmare and P. Ratnasamy—National Chemical Laboratory, Pune.

905/DEL/89: A process for the preparation of an improved catalyst composite material useful for the hydrodewaxing of petroleum oils, A.N. Kotasthane, V.P. Shiralkar, A.J. Chandwadkar, S. Sivasanker and P. Ratnasamy—National Chemical Laboratory, Pune.

906/DEL/89: A process for the production of cycle oils having lower pour points, S. Sivasanker and P. Ratnasamy — National Chemical Laboratory, Pune.

946/DEL/89: Improvements in or relating to the process for manufacture of fuel gas from slack solid fuel, particularly high ash coal, D.K. Biswas, M.N. Juneja, A. Majumdar, S.K. Rao and R. Haque—Central Fuel Research Institute, Dhanbad.

947/DEL/89: A process for the preparation of a compound from lignin—a paper mill waste, and formaldehyde which is useful to remove mercury from industrial waste, A.M. Deshkar, S.S. Dara, S.S. Bokade, D.Y. Ratnaparkhi, S.R. Joshi and V.P. Thergaonkar—National Environmental Engineering Research Institute, Nagpur.

948/DEL/89: An improved automatic burette, A.S. Bal and H.J. Patil—National Environmental Engineering Research Institute, Nagpur.

949/DEL/89: A process for the preparation of cementatious binder from aluminium industries waste red mud, R.K. Chauhan and A.C. Khazanchi—Regional Research Laboratory, Bhopal. □

ANNOUNCEMENTS

Short-term Courses for Library and Information Professionals

The Indian National Scientific Documentation Centre (INSDOC), New Delhi, will be organizing the following short-term courses during 1990-91, for Library and Information professionals:

Name of the course	Date of starting	Duration
Computer application to library & information activities (for freshers) (MSDOS, CDS/ISIS, dBase III Plus, Wordstar, Lotus 1-2-3)	2 April 1990	4 weeks
CDS/ISIS (Ver. 2-3) (for those having knowledge of CDS/ISIS Ver. 1.0)	9 July 1990	4 weeks
Computer application to library & information activities (for freshers) (MSDOS, CDS/ISIS, dBase III Plus, Wordstar, Lotus 1-2-3)	20 August 1990	4 weeks
Bibliometrics	22 October 1990	1 week
dBase III Plus	19 November 1990	4 weeks
CDS/ISIS (Ver. 2-3) (for those having knowledge of CDS/ISIS (Ver. 1.0)	7 January 1991	4 weeks
Information Technology (online access, electronic mail, CD ROM Videotex, Teletex, etc.)	10 February 1991	2 weeks
dBase III Plus	4 March 1991	4 weeks

Course fees:

Four-week course:	Rs 2,500 (with accommodation) Rs 2,000 (without accommodation) $ 1,250 (with accommodation) (for foreigners)
Two-week course:	Rs 1,250 (with accommodation) Rs 1,000 (without accommodation) $ 625 (with accommodation) (for foreigners)
One-week course:	Rs 625 (with accommodation) Rs 500 (without accommodation) $ 315 (with accommodation) (for foreigners)

The maximum number of seats in each course is 15. Seats in these courses will be provided on first come first served basis. Library and Information professionals interested to undergo these training courses may contact: Shri B.K. Sen, Deputy Head, Education & Training Division, INSDOC, New Delhi 110067. □

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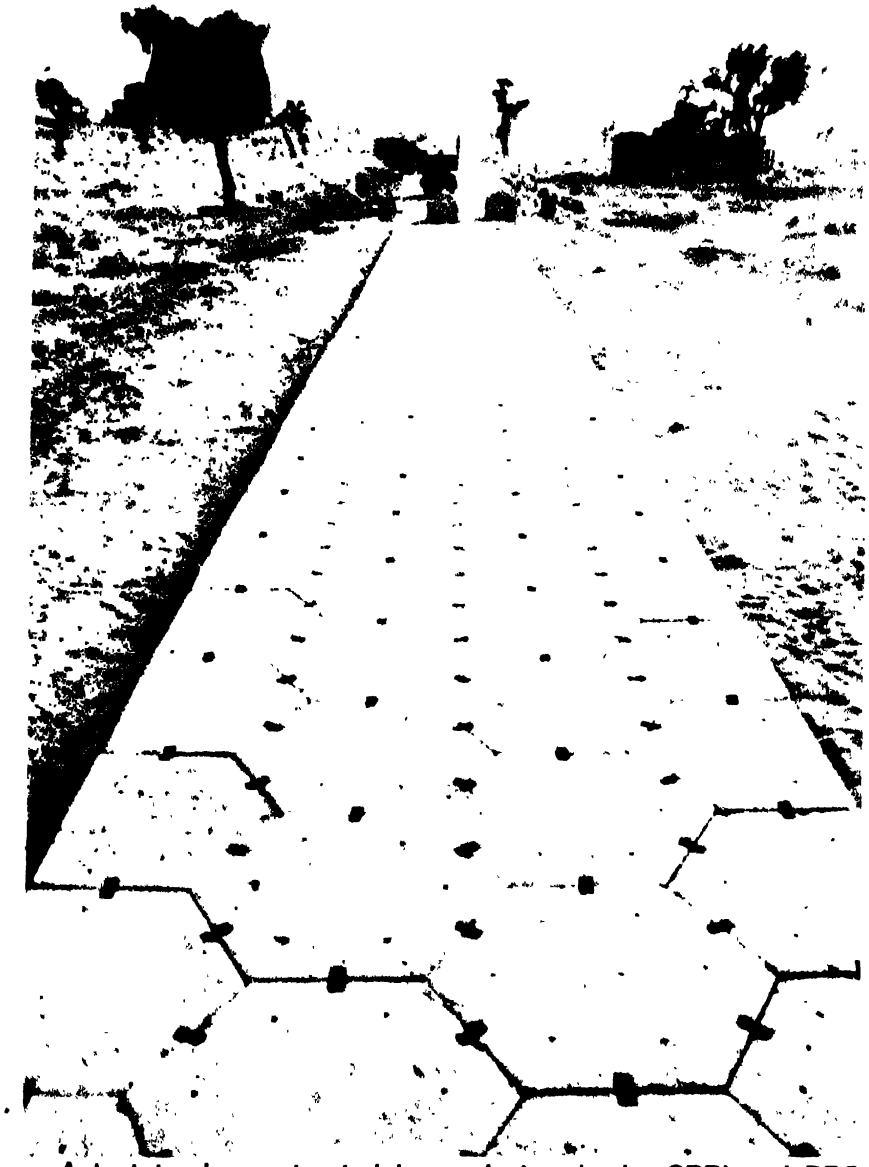

A test track constructed in sandy terrain, by CRRI and BRO using the precast hexagonal concrete block technology. A summary of the CRRI Annual Report: 1988-89 appears on p. 20

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Symposium on Coal Utilization : Trends & Challenges

The Central Fuel Research Institute, (CFRI), Dhanbad, organized a symposium on 'Coal Utilization Trends & Challenges' on 13-14 December 1989 The objective of the symposium was to take stock of the past experiences and to further rationalize the utilization pattern of this fossil fuel in the country Forty-seven organizations/institutes concerned with coal were represented through 112 delegates and 11 other dignitaries. The symposium comprised a plenary session, four technical sessions on specific themes, a poster session and a summing-up session

Plenary Session

Dr R. Haque, Director, CFRI, presided over the plenary session In his address, Dr Haque discussed the unique aspects of Indian coal, its inferior quality and difficult beneficiation characteristics, and stressed the need for periodic review of coal utilization and for adoption of forward technologies, especially in the areas of coal for steel, coal beneficiation and coal for power.

In his plenary lecture, Shri P.R. Sinha discussed the uniqueness of Indian coals. He said that though the same Gondwana coal constitutes the major coal deposits of India, Australia and Africa, geological and geochemical factors have rendered the Indian coal different, and special R&D efforts are needed for its rational utilization. He also stressed the need for modernization of the coal industry and adoption of the latest technologies. He stated that with increased quantum of coal from deeper seams as well as enhanced mechanization, further deterioration and degradation of coal quality is inevitable. The scientists and technologists should, therefore, make efforts for meeting the challenging tasks pertaining to coal utilization in future. He also mentioned the necessity of evolving appropriate technologies for the production of clean coal, acceptable to different industries, economical utilization of coal-water mixture or coal-oil mixture, particularly as a substitute for petroleum products; coal for steel, particularly in the areas of formed-coke technology and direct reduction process; fluidized bed combustion and the emerging technology for production of power economically through integrated gasification combined cycle for using high ash coal and coal washery byproducts.

In the address of Shri Joharapurkar, ex-CMD, PDIL (read out by Shri Tangri), it was contended that though the utilization pattern of coking coal is optimum in iron and steel industry, it is not so in the case of non-coking coal Non-coking coal is being used primarily for generation of power and steam, and to a limited extent, in the manufacture of fertilizers. There is sufficient room for its utilization as feedstock for chemicals. Though, the current availability of petroleum feedstock has pushed the utilization of indigenous coal to a rear stage, the petroleum feedstock may not be available indigenously beyond three or four decades and from abroad, for another five decades. This should be taken into consideration for evolving future pattern of utilization of non-coking coal. He stressed that apart from utilizing non-coking coal through emerging technologies for power generation, one should also consider production of fertilizers and chemicals through gasification, and of synthetic crude through gasification or direct hydrogenation.

Technical Sessions

The first technical session was on Resource Quality Assessment (Chairman: Shri S.P. Mathur, Chairman-cum-Managing Director, CMPDI and Co-chairman: Dr D. Radeck, Institute of Chemical Technology, GDR). The eight papers that were presented dealt with resource exploitation, optimal utilization and quality assessement, influence of coal quality on boiler performance, modern mining methods, a new rationale of coal classification for steel plant use and correlation of calorific value with proximate analysis of coal used in thermal power plants.

The second technical session was on Coal Preparation and Beneficiation (Chairman: Dr R.N. Singh, Director, Coal Preparation Engineering Institute, CMPDI, Ranchi; Co-chairman: Prof. Samir Sarkar, Department of Chemical Engineering, IIT-Bombay). Twelve papers were presented, which discussed mathematical modelling of unit operation in coal washeries, beneficiation of middlings and fine coal recovery by froth-flotation, beneficiation of low grade coking coal, oil agglomeration technique, oleo-flotation, chemical pretreatment prior to comminution of coal, processing and disposal of washery, wastes and coal slurry preparation for pipeline transportation.

Shri P.R. Sinha, Chairman-cum-Managing Director, BCCL, delivered the keynote address in which he dealt with the challenges in coal preparation to meet the quality requirements of the metallurgical industry and power plants in India. He mentioned that in the metallurgical sector, though the requirement of coal ash remains limited to 17.0 ± 0.5%, the prevailing ash level in the indigenous coking coal is around 19.5 ± 0.5%. Presently, to limit the ash content in the coal blends for coke-ovens to 15.5% judicious import of low ash coal from abroad is being resorted to and the trend is increasing. Shri Sinha was of the opinion that modern coke oven practices, like stamp charging, preheating, selective preparation, technologies like formed coke and pelletized coke should be tried for effective utilization of indigenous coal instead of its large scale import. Dis-

Technical session on 'Resource Quality Assessment' in progress, with Shri S.P Mathur, Chairman-cum-Managing Director, CMPDI, as Chairman and Dr D. Radeck, Institute of Chemical Technology, GDR, as Co-chairman

cussing the steps taken by BCCL in this regard, he said that in the new washeries under construction, circuit has already been designed to crush raw coal to −13 mm size with deshaling Froth-flotation circuit, elaborate instrumentation and automation has also been incorporated to ensure quality control.

The subject of the third technical session was: Coal for Steel and Allied Industries (Chairman: Shri B.K. Mazumdar, ex-Director, CFRI and Co-chairman: Prof. Samir Sarkar, Department of Chemical Engineering, IIT-Bombay). Twelve papers were presented, which covered: pyrolysis of coal, coal petrography in coke making, swelling and shrining of coal in coal carbonization, metallurgical coke, new testing facilities, modern coke oven practices, coke from low grade coal for foundry, coal preparation for improved coke making, mathematical modelling of temperature profile in rotary kiln for sponge iron industry as well as pollution and its control in carbonization industry.

Shri Y.P. Dhawan, Director of Collieries, TISCO, in his keynote address discussed the problems of quality of coal for steel industries in respect of high ash, low vitrinite and high inertinite content in comparison with the quality of this raw material in other major steel producing countries and the associated problems of low blast furnace productivity and higher coke rate. He stressed the need of treating the entire collieries, washeries, coke ovens and blast furnaces as a composite unit from the economic viewpoint, productivity of blast furnace being the main objective While discussing several parameters being considered at present for coking coal, he suggested a new grouping based on these parameters. He also suggested the limits of the parameters of the blended coal and the resultant coke for reasonably good blast furnace performance. He opined that for maintaining the desired productivity, blending with low ash imported coal was the only answer to achieve the desired sweetening effect and to compete in the international steel market, and described the experiences gained at TISCO on trials carried out with coal from Australia, Canada, West Germany, Poland, China, New Zealand and America, in blends with washed coals from Jamadoba and West Bokaro. For countering the problems associated with the large scale import of coal, he suggested to concentrate on: (i) manufacture of special steels for export with a view to earning additional foreign exchange, (ii) prospecting of ocean areas adjoining the country's extensive sea shore and higher Himalayas for exploitation of strategic minerals for export, (iii) extensive R&D on desulphurization of Assam coal for its ultimate use in coke making, (iv) re-location of Jharia township and inhabitations around, for exploitation of vast deposits of coking coal confined under these areas and (v) suitable use of resources of non-coking coal for steel making. He also emphasized the need for adoption of modern coke oven practices

'Challenges in Indian Coal Industry' was the subject for the fourth technical session (Chairman: Prof. P D Sunavala, IIT-Bombay and Co-chairman: Shri S.K Sen, G M. (Lodna), BCCL Six papers were presented in this session dealing with: characterization of coal hydrogenation derived liquids and the correlation of their yield with the H/C ratio, underground coal gasification, future perspective of coal based power plants, coal tar binders, processing of tar for its use as binder for formed coke, and the scope of winning and utilization of Jhama.

In the keynote address in this session, Dr Ram K. Iyengar, Additional Director General, CSIR, dealt mainly with coal for power. He said that at present 65% of the total energy requirement of the country is met from high ash non-coking coal in pulverized form, over and above the middlings and sinks available from 17 coking coal washeries in the country. Almost 30% of coal production is utilized in the power stations The trend is likely to increase and by 2000 A.D. over 300 million tonnes of coal will be consumed to meet the energy needs of the country. Because of high ash in Indian coal, beneficiation of

noncoking coal for power generation has become imperative for economic reasons. Currently, beneficiation is limited to only coking coal. For this purpose, because of the inherent nature of Indian coal, frontier technologies for non-coking coal beneficiation would have to be considered. Discussing alternatives to adopting forward area technologies in the utilization of high ash coal for power generation, he suggested that for small scale power generation up to 30 MW, micronized coal system might be appropriate as this could be a suitable substitute for gas and oil; for medium scale power generation (30-100 MW), circulating fluidized bed system might be appropriate and for 500-600 MW power generation, IGCC technology based on dry entrained bed or fluidized bed gasification could be an effective alternative. Use of beneficiated coal in these processes would have an added advantage.

Poster Session

The poster session comprised fourteen posters, covering the various aspects related to coal utilization, e.g. non-polar adsorbent for gas chromatography, oxidation of toluene to benzaldehyde, rheology of suspension of lignite in moderate viscous fuel oil, chemicals and liquid fuels from coal, and application of catalysts from conversion of syngas, waste utilization, coal water mixture fuel, fertilizer and humic acid rich product from lignite, chemical pretreatment for comminution and selective agglomeration, analysis of coal tar pitches for different industrial uses using FTIR, clean producer gas from low grade coal and parameters for use of brown coal in hydrogenation.

Recommendations

The major recommendations that emerged from the deliberations of the symposium are as follows:

1. Resource quality assessment should be modernized to cope with the increased demand of coal analyses, commensurate with the doubling of coal production during the next decade. It should be borne in mind that the recoverable resources with the existing mining technology may not exceed 30%. Low volatile medium coking coals comprising about 45% of the coking coal reserves should preferably be used in steel plants instead of power plants.

2. In view of the more stringent specifications envisaged for the quality of coking coals for improved performance of the modern blast furnaces in terms of productivity, coke rate, etc., newer and emerging technologies of coal beneficiation (small-coal washing cyclone, oil agglomeration, oleo-flotation, etc.) and carbonization, selective crushing, PBCC, stamp charging, use of SRC, etc should be duly considered. These technologies should be developed to an appropriate scale for demonstration prior to their commercial adaptation for reducing the import of prime coking coal. Replacement of M10 and M40 indices by parameters like CRI and CSR should be considered after ascertaining positive benefits.

3. Beneficiation of non-coking coals, particularly for power generation, should also be a mission-oriented project for developing suitable technologies with low capital investment and reasonably low operational cost (Rs 25-30 per tonne input).

4. With the opening up of possibilities for economic thermal power generation by the Atmospheric Fluidized Bed Combustion (AFBC) of very high ash coals/washery rejects, the second generation technologies like Circulating Fluid Bed Combustion (CFBC) and Pressurized Fluid-bed Combustion (PFBC) should be developed to an appropriate level, jointly by the concerned national agencies. Simultaneously, modern facilities should be created to determine the nature and extent of abrasive minerals, like α-quartz, present in coals.

5. Lignite being potentially a low ash carbonaceous material, diversification of its use should be investigated.

6. Important methodologies based on mathematical modelling, theoretical analysis, CAD, etc should be developed to ensure continuous refinement of R&D activities.

7. Environmental aspects associated with coal mining, coal preparation and coal conversion areas should receive due consideration to obviate pollution hazards.

8. Important coal utilization programmes should be viewed as a national mission, involving the major government agencies and user industries. CFRI would continue to work as the nodal agent.

9. With the rapidly changing scenario of the technology mission, at least one symposium in three years should be held for assessing the status of and improvements in coal utilization technologies. □

Eleventh International Congress of Essential Oils, Fragrances and Flavours inaugurated by Dr A. P. Mitra, DG, CSIR

Dr A.P. Mitra, Director General, CSIR, inaugurated the Eleventh International Congress of Essential Oils, Fragrances and Flavours, held in New Delhi, on 12 November 1989. This Congress is held once in three years; the last one was held in Washington, USA.

In his inaugural address, Dr Mitra said that the holding of the Congress in India was an acknowledgement of the tremendous strides made in science and technology in the country. As in other developed civilizations, perfumery products have found wide use in India since ancient times. They

have been used as cosmetics and as essential ingredients in religious rites. Being a country with climatic conditions varying from tropical to alpine, a wide variety of plants can be grown in India.

Several Indian essential oils produced by steam/hydrodistillation have found extensive use in perfumery industries The names of sandal wood, lemongrass and palmarosa oils could be cited as examples. To the traditional techniques we are now adding advanced techniques such as genetics, tissue culture, cell culture and solvent extraction, which have found extended use in the more developed western countries. Newer ways of isolation, separation and structure determination have been developed in recent years. These developments have led to the idea of structure-odour relationship. Based on this, it is now possible to carry out a total synthesis of a perfumery product or to synthesize a substitute which will simulate the odour of the known perfumery ingredient.

A large number of academic and research institutes in India are engaged in researches pertaining to the theme of the Congress. CSIR took major steps to initiate research and development work in the area of essential oils, flavours and fragrances in its following laboratories: Central Institute of Medicinal and Aromatic Plants, Lucknow; National Botanical Research Institute, Lucknow; Central Food Technological Research Institute, Mysore and Regional Research Laboratories at Jammu, Jorhat, and Trivandrum. As a result of their efforts, India is producing essential oils other than those which were being produced before 1950s or 1960s. It has now technologies for exploiting many aromatic plants which are available wildly in various parts of the country. Also, it has initiated action to adopt and cultivate many of the aromatic plants which are found to be of commercial importance by developing high quality varieties giving higher yields and possessing higher oil content. Some of such oils are ajowan oil, basil oil, celery seed oil, citronella oil, davana oil, geranium oil, ginger oil, hops oil, jasmine concrete and absolute, lavender oil, lemongrass oil, mint oils—spearmint, Scotch spearmint, garden mint; palmarosa oil, vetiver oil and many others.

Dr Mitra cautioned the scientists, technologists and industrialists in the field of essential oils, fragrances and flavours against the over exploitation of the natural resources, both in the in fulfilling the ever increasing demand for flavour and fragrance products. He desired that adequate attention should be given to the development of rare plants that are becoming endangered owing to over exploitation.
exploitation

Dr Mitra further said that although the synthetic products mimic the natural products quite well, they cannot be the same In plant extracts one gets not only the active principles but also many other chemicals in trace quantities which bring in some kind of balance The problems with the use of pure synthetic products are very well known. They are often carcinogenic and show toxicity on long term use as flavours, fragrances and cosmetics Evaluation of carcinogenicity and toxicity should receive adequate attention prior to the use of new molecules/chemicals as cosmetic products or as flavours in foods and beverages.

The research and development programmes in India and other developing countries should be directed towards developing such agro-technologies which promote profitable production of aromatic plants at a rate much cheaper than the synthetic and also address themselves to problems of toxicity. This can be done only through intensive team work amongst agricultural scientists, chemists and chemical engineers

Dr Mitra called upon the developing countries to harness the agricultural science so as to break the 'yield-barrier' in order that the essential oils industry in future depends on natural essential oils rather than on synthetics.

We will have to improve the present distillation methods and set up modern processing industries in order to export value added flavour and perfumery chemicals in place of natural raw materials and unrefined essential oils. Also, we will have to pay greater attention to developing village level technologies, which are both efficient and able to produce quality products. These measures will increase the foreign exchange earnings, and create ample job opportunities for a wide cross-section of rural/urban populations.

Dr Mitra expressed his concern over the pre-eminent position of India being threatened by: more countries entering the market; introduction and sophistication of manmade fragrances based on synthetic molecules; high science based blending technology, and reliance on quality control based on more rigid standards. These challenges have to be met squarely by the Indian scientists, technologists and industrialists jointly.

Despite the advantages India has with respect to favourable conditions for production of most essential oils from natural sources and scientific and technological capability and infrastructure in the research laboratories to synthesize a large number of aroma chemicals by novel routes, the value of annual sale of Indian essential oils, flavours and fragrances is of the order of Rs 2500 million against the world figure of Rs 11,9000 million, which means that India's share is only 2%. Indian export is of the order of Rs 600 million and import around Rs 150 million.

The reason for this situation is not difficult to trace; only a few industrial houses in India are really equipped to make use of or create new knowledge and technology with their in-house efforts. Indian aroma industial units will have to be managed more professionally to take advantage of the new developments around the

world and to have the ability to adopt them. This should be done at the earliest to become more competitive internationally and to have a proper share in the international trade.

Many developing countries, and India in particular, today have modern R&D infrastructure engaged in development of improved technologies in the field of aromatic plants However, for using these technologies for economic development, the governments of the developing countries will have to organize production and marketing mechanisms, not only by private sector agencies, but also by the public sector, and channel all efforts and inputs through a Board having representatives from the R&D units, private industries and the public sector. National industrial associations will also have to play their role in healthy development of the industry. □

CSIR participates in Nehru Kisan Mela

The Ministry of Agriculture, Government of India, organized 'Nehru Kisan Mela' at Allahabad during 11-19 November 1989. The Department of Science and Technology, New Delhi, coordinated the S&T part of the exhibition. CSIR participated in the exhibition by displaying its technologies on rural development. Farmers, Students, small scale entrepreneurs engaged in agro-based industries, visiting the exhibition, were explained the importance of self-explanatory exhibits on medicinal and aromatic plants. These plants can be cultivated without disturbing the land utilization pattern in the country and without affecting the production of food crops. For example, Japanese mint (*Mentha arvensis*) can be grown in rotation with paddy and early mustard or after a crop of early maize followed by potato crop, giving additional income to the farmers. Mints can also be grown as intercrop with sugarcane Farmers were also explained the cultivation methods of citronella and palmarosa which are suitable for intercropping with trees like eucalyptus and poplar. The other grasses and plants which evoked farmers' interest were vetiver and lavender.

The visitors were also told about the major medicinal plants *Catharanthus roseus, Rauvolfia serpentina, Hyoscyamus muticus, Duboisia myoporoides* which can be grown as cash crops. The working units for field distillation, which can be fabricated easily for aromatic plants such as mints, vetiver, geranium, davana, were also displayed. The CSIR participation was coordinated by the Central Institute of Medicinal and Aromatic Plants, Lucknow. □

CIMAP participates in IITF '89

The Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, participated in the India International Trade Fair (IITF)-1989, held at Pragati Maidan, New Delhi, during 14-29 November 1989. The special theme of the IITF'89 was: Essential oils, Fragrances and Flavours CIMAP displayed the important essential oil-bearing plants, viz., lemongrass, palmarosa, vetiver, citronella Java, lavender, clarysage, Bulgarian rose and all the four varieties of mints along with oils obtained therefrom.

A working model of improved field distillation unit developed by CIMAP for distilling various aromatic crops such as mints, aromatic grasses and other essential oil-bearing plants was also displayed. This unit attracted a large number of visitors who were apprised of the salient features along with its economic viability for a small scale producer.

Visitors to the Nehru Kisan Mela being explained the agro-technologies for aromatic plants, and working of the improved distillation plant

A large number of distinguished scientists, industrialists, growers, perfumers and distillers visited the CIMAP stall. Literature describing the activities of CIMAP and technologies available, was distributed among the visitors. □

CFTRI signs MoU with US Wheat Associates, for research programme on suitability of soft white wheat for Indian style wheat-based culinary and confectionery products

The US Wheat Associates, an organization of American wheat farmers, has launched a short term research programme on suitability of soft white wheat for Indian style wheat-based culinary and confectionery products, at the International School of Milling Technology (ISMT), Central Food Technological Research Institute (CFTRI), Mysore. A Memorandum of Understanding (MoU) regarding this was signed by Shri L.R. Khandhari, Director, US Wheat Associates and Shri M.M. Krishnaiah, Head, ISMT, at a simple ceremony organized on 18 December 1989. Dr B.L. Amla, Director, CFTRI; Prof. M.M. Chakraborty, Chairman, CFTRI Research Council and other experts were present.

Briefing the newsmen on the agreement, Dr Amla said that the suitability of white wheat variety may have some advantages in making biscuits, *chapatis* and other food products. The ISMT scientists would assess the likely usage of whole wheat meal (*atta*) and flour (*maida*) produced from US soft white wheat and Indian variety wheat for Indian traditional products (bread, *chapatis*, buns, *parothas*, *pooris*) and confectionery products (cakes, cookies, Danish pastries, etc.).

The research programme envisages a study of milling, chemical, rheological, sensory and test baking characteristics of both US and Indian wheat flours. The traditional and confectionery products so prepared willl be subjected to large scale evaluation and consumer acceptance studies at CFTRI and local bakeries With the expertise available at ISMT, Shri Krishnaiah expressed his confidence for delivering the results by August 1990, the target period mentioned in the MoU. US Wheat Associates will reimburse the project cost, estimated at Rs 2 lakh, after the completion of the research programme.

Shri Khandhari said that USWA is an organization of American wheat farmers, which promotes maximum nutrition and effective utilization of wheat and wheat products exported to other countries. Commending the role played by ISMT in rendering training on the basics of flour milling, Shri Khandhari said that more than 100 participants had been trained under the USWA sponsored programme.

Prof. Chakraborty, Chairman, CFTRI Research Council, hoped that the research outcome of the programme would benefit the South-East Asian countries also. □

Shri L.R. Khandhari, Director, US Wheat Associates, exchanging the MoU document with Shri M.M. Krishnaiah, Head, ISMT, CFTRI, Mysore. Others on the dais (from left to right) are: Dr B.L. Amla, Director, CFTRI, and Prof. M.M. Chakraborty, Chairman, CFTRI Research Council

CSIR establishes NRI Unit

The Council of Scientific & Industrial Research (CSIR), New Delhi, has established a Unit to Interface with Non-Resident Indian Scientists and Technologists (INRIST), with effect from 1 January 1990. The unit will be responsible for the ongoing Transfer of Knowledge through Expatriate Nationals (TOKTEN) programme and Scheme for Transfer of Knowledge/Knowhow through Talented Indian Engineers and Scientists (STOKTIES)

In order to achieve its objectives, the unit will compile and analyze information available on NRIs' expertise and will establish contact with science and education counsellors in Indian missions abroad and foreign missions in India and various scientific and technical departments of the central and state governments, public undertakings, investment centres, industrial development corporations, chambers of commerce and industry and confederation of engineering industry, etc. on behalf of NRIs.

All enquiries, proposals and recommendations related to INRIST may be sent to: Dr Sushil Kumar, Head of Human Resource Development Group, CSIR, Rafi Marg, New Delhi 110001; or Dr S.C. Majumdar, Head of INRIST, CSIR Complex, NPL Campus, Pusa, New Delhi 110002. □

CCMB celebrates Foundation Day

The Centre for Cellular & Molecular Biology (CCMB), Hyderabad, celebrated its 2nd Foundation Day on 26 November 1989.

The Foundation Day lecture was delivered by Dr Sydney Brenner, FRS, FRCP, Medical Research Council, Cambridge, UK. He spoke on 'The New Genetics'.

After the lecture, Dr Brenner presented the Young Scientist's Award to Dr Gowrishankar of CCMB. He also presented prizes to children of staff, who had participated in a painting competition, the entries of which were judged by Mr Li Yan, an internationally known Chinese painter, who was at CCMB recently.

Earlier, Dr P.M. Bhargava, Director, CCMB, introduced the guest speaker, and Dr D. Balasubramanian, Deputy Director, CCMB, proposed a vote of thanks. □

PROGRESS REPORTS

CRRI Annual Report: 1988-89

The Central Road Research Institute (CRRI), New Delhi, has brought out its annual report for 1988-89. According to the report, the significant R&D achievements of the institute during the year were as follows:

Geotechnical Engineering

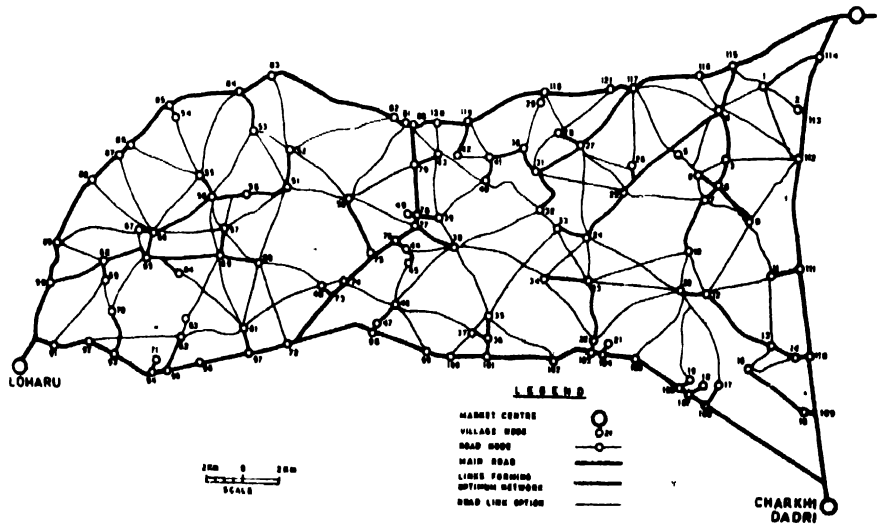
The laboratory tests conducted by the institute established the usefulness of stone columns, both as efficient drains and as a reinforcing inclusion to improve the bearing capacity of marine clays and other weak strata. Full scale tests were in progress at Visakhapatnam to improve the bearing capacity of 12-16 m thick soft marine clay to enable it to withstand ore stacks of 9 m height. The laboratory continued to carry out work on characterization of geotextile materials. These synthetic fabrics are being used in roads to improve their structural strength. In the control of rock slides, use of geogrids was made as a swinging barrier and also as a surface cover. A computer programme was developed for the design of earth retaining structures with reinforcement.

Soil Stabilization & Rural Roads

For constructing lowcost roads in rural areas, a tractor bound technology involving the use of a number of agricultural implements was developed. It was estimated that by using these implements, a saving of 10-40% can be achieved in the construction of rural roads. For providing large network of roads in the rural areas such that each village gets connectivity to larger markets and other important places, a comprehensive planning methodology aiming at generation of a basic rural road network at minimum cost was developed. This network methodology includes planning, construction, maintenance, travel costs and social and economic benefits. It is based on iterative process and has been tried successfully in a few rural sectors. As a corollary to this methodology, socio-economic aspects of rural roads and travel characteristics of different segments of rural population were analyzed. To impart durability to roads using soil lime mixes, a design criterion on the quantity of lime to be added was developed. Research studies were also conducted on the use of magnesium oxychloride cement as a stabilizing material both for clayey and sandy soils. Test results on the use of wastes like rice husk and fly ash were quite encouraging to qualify these materials for use in road construction.

Bitumen

Strength characteristics of stabilized materials and metallic bases, which simulate water bound macadam construction, were determined. A repetitive triaxial equipment was fabricated to determine 'E' dynamic values for the design of pavements. A test track was constructed to study the effect of anti-stripping chemicals in prevent-



Optimal rural road network for a typical rural region

ing the stripping of quartzite aggregate and the efficacy of crack relief layer to prevent reflection cracks. The guidelines for the use of anti-stripping agents were being formulated. Specifications for restoration of cuts and trenches, rehabilitation of holes, etc., for maintenance of utility services, were worked out. Also, a specification for the flooring using mastic asphalt, for light hydro-carbon industries, was worked out.

Physico-chemical properties of various paving grade bitumens obtained from different refineries were investigated inter-alia for asphaltene, naphthalene aromatics and polar aromatics. Using the ultra-violet exposure tests and thin film oven tests, their ageing properties were evaluated. A simple potentiometric test procedure was developed to determine the concentration of an anti-stripping agent in bitumen and road mixes before using them in construction. Studies showed that bituminous binders improve viscosity-temperature relationship. The properties of road tars could also be improved by organic polymers and rubber. Durability of bituminous surfacings was found to be enhanced by the chemical additives and appreciable reduction in oxidative hardening was also achieved by incorporating suitable compounds.

Pot hole on NH-2 patched with MPC mortar

Rigid Pavements

An experimental test track was constructed to examine the possibility of using roller compacted concrete in construction of pavements having better compaction and riding quality; its performance was being observed. Concrete slabs were made adopting new materials and their performance was being studied. Use of super plasticizers was being studied with a view to lowering the water/cement ratio, by way of determining the increase in comprehensive strength, durability, shrinkage, etc. Research work was also continued on polymer impregnated concrete and granulated blast furnace slag. Efforts were being made to obtain the desired surface texture for improved skidding.

Roads

Further studies were carried out on the measurement of skid resistance on 16 typical test sections with the help of skid trailer and mu-meter. The skid resistance values obtained with mu-meter were found to be numerically less than those obtained by pendulum tester. However, a relationship existed between the skid resistance values obtained by these two methods. Study on polishing characteristics of aggregates was continued and eight typical samples of aggregates were tested for their polishing susceptibility value under heavy traffic conditions.

Performance observations were being made on two experimental stretches constructed earlier in Rajasthan with hexagonal concrete blocks. Both the stretches have been found to be performing well under traffic, for the last many years. In addition, 14 units of bump integrator were calibrated during the year. To determine the axle loads of vehicles plying on national highways, the relevent data were collected at three important locations. The initial results pres nted rather a dismal picture in regard to the frequency and magnitude of overloading.

Bridges

Laboratory studies were completed on synergetic effect of phosphonocarboxylic acid and sodium nitrite as inhibitors in zinc rich organic and inorganic base paints. Based on the observational data collected on thermal movements of Moolchand flyover in New Delhi, three types of expansion joints were proposed to cater to the movement up to 15 mm, 20-30 mm and up to 40 mm. For strengthening of RCC structural elements by externally bonded steel plates, a set of beams was designed and cast.

Traffic

Studies were made to identify and work out the cycle track routes and their geometrics, for Delhi Metropolitan area. Under a project relating to mode specific tracks for Delhi urban

area, traffic data have been collected over a period of 15 years on 10 arterial roads carrying heavy volumes of traffic. The data were finally analyzed to determine the position of traffic and its changing trend. The analysis reveals that light, fast vehicles normally use innermost lane, heavy vehicles and two-wheelers use the middle lane and cycle traffic confines to the side line. An estimation of traffic in 1991 was made on the basis of numerous growth factors. Computer models using algorithms were built for the turning flow of traffic at important intersections. A comparison of different models was made on the basis of entropy test. On the basis of current volume of traffic, extrapolations were attempted to estimate the traffic flow in future years. To assess the pattern of urban development in relation to accessibility, data collected on density of residences and places of employment in central Bombay and Delhi, were analyzed. Travel behaviour was studied in Bombay region to prepare mode split models. It was noticed that mode of travel is related to socio-economic status, location and availability of different modes of travel. The disaggregated models for trip generation were developed on the same basis. Voluminous data collected from the transportation planning studies would serve as a good database for further analysis and research. Keeping in view the mounting population of Delhi, traffic projections were estimated in terms of volume of traffic on the roads and mode of travel. With a view to achieving optimisation in the utilization of public transport services, data were collected on two routes and measures were suggested to improve operational efficiency. Household travel data were collected for Delhi to determine trip rate per capita and mode of travel. To plan transportation strategies, mobility levels and transport problems of different cities with varying population, were studied and recommendations were made on the basis of data collected. This study was sponsored by the Planning Commission.

Traffic carrying capacity and speed flow relationship was studied in urban areas. In addition, effect of increased street lighting on the speed and capacity of roads was also investigated. Data were also collected to develop similar model on the basis of road and traffic characteristics both in plains and rolling terrains. A study was initiated on goods movement in urban and suburban areas and the traffic generating points were identified

Environment and Road Traffic Safety

As a part of the project on road traffic accidents and road user behaviour, a large number of drivers with varying driving records were subjected to psycho-physical and psychological tests to frame norms and standards for drivers of different age groups and to ascertain their suitability for driving. An equipment for drivers evaluation was developed in collaboration with the Central Scientific Instruments Organisation, Chandigarh.

Analysis of data collected over a period of years showed that involvement of cyclists and pedestrians in accidents is linked with their social and economic status, e.g. both cyclists and pedestrians meeting with accidents belong to all age groups but a major percentage of fatalities take place among poor sections. The study points out to the need for special orientation and other measures for those visiting large urban centres without proper awareness of lurking danger on city streets. Buses and trucks are the vehicles mainly responsible for accidents.

To arrive at a rational design of speed breakers, various combinations of length and height were tried. The study showed that the amount of discomfort caused at various speeds is minimum when the base length is 3-4 m and height varies from 8 to 12 cm. Besides, different designs of road markings on speed breakers were tried to choose the one which is most easily discernible from a distance.

On the environmental aspect of traffic, measurements on the level of noise were made in some important areas. It was found that the noise level in these areas exceeded tolerable limits. The study also revealed that noise emission levels of two wheelers exceeded the permissible value of 84 dB. A study was initiated to monitor the noise emission levels of vehicles at different speeds. Initial results showed that noise emission increases with the speed of the vehicle.

Pavement Performance Study

The performance monitoring of existing pavement sections made a big headway. However, the work on main study site in Haryana, i.e. on NH1 (new pavement sections) could not proceed further owing to variations in the quality of formation and subgrade soil in excess of the permissible limits for the research objectives involved. A site in Karnataka was selected for one of the sub-studies.

Miscellaneous Activities

A bullock-cart was fitted with flexible element with a view to having more tractive efficiency. A revised design was developed for the flexible element so that hubs of smaller diameter could also derive the advantage of reduced tractive efforts and avoidance of knife edge loading. Also, a transverse profilograph was developed.

The institute organized 16 training courses for in-service personnel; as many as 362 personnel received training through these courses. ESCAP (UN) has assigned to CRRI a major part of one-million dollar project on training & technology transfer in respect of rural roads. The first course for roads in humid tropics was held at CRRI in August 1989. □

* * *

Physics Instrumentation in India — Special Numbers of IJPAP

The Publications & Information Directorate, New Delhi, is bringing out a publication (in two parts) on 'Physics Instrumentation in India'. The publication, being brought out under the distinguished leadership of Dr K.R. Rao, Guest Editor, Bhabha Atomic Research Centre, Bombay, highlights the sophistication achieved in instrumentation related to frontline areas of physics research in India.

The first part of the publication (July-August 1989 number of *Indian Journal of Pure & Applied Physics*) has already been brought out. It contains 24 review articles covering instrumentation facilities for research activities in the fields of Astronomy & Astrophysics, Condensed Matter Physics, High Pressure Physics, Oceanography and Biophysics. Author and keyword indices have also been provided. This part (pp. 220) is priced at Rs 100 (£ 22 or $ 34).

The second part (September-October 1989 number of IJPAP) is in the final stages of printing. This part also contains 24 review articles along with author and keyword indices, covering the instrumentation related to Laser Physics, Electronic Instruments, Reactor-based Research Activities, Accelerator and Nuclear Physics, Elementary Particles and Particle Physics.

The publication would be a valuable reference source for experimental physicists. For copies of the publication, please write to: The Sales & Distribution Officer, PID, Hillside Road, New Delhi 110012. □

Special Issue of IJRSP on Indian Middle Atmosphere Programme

The October-December 1989 issue of *Indian Journal of Radio & Space Physics* has been brought out as a special number devoted to Indian Middle Atmosphere Programme (IMAP). IMAP which began on 1 January 1982 and continued till March 1989, was the most comprehensive Indian programme on the atmospheric environment since IGY, involving the participation of some 200 scientists. The programme was divided into five broad disciplines: (i) minor constituents and atmospheric chemistry, (ii) atmospheric dynamics, (iii) radiation; (iv) ionization and electrodynamics, and (v) modelling and theoretical studies. The issue contains 26 articles written by specialists covering different aspects of middle atmosphere. The issue should, therefore, be of immense interest and utility to space scientists, particularly to those working in the realm of middle atmosphere. The publication should also serve as a valuable reference source for all those working in the associated fields of research.

The issue [pp 150 + vi; price Rs 50 (£ 11.00 or $ 17.00)] can be had from: The Sales & Distribution Officer, Publications & Information Directorate, Hillside Road, New Delhi 110012.

CONFERENCE BRIEFS

International Conference on Coal Science

Prof. B.K. Mazumdar, Emeritus Scientist, CSIR and former Director of the Central Fuel Research Institute (CFRI), Dhanbad, attended the International Conference on Coal Science, held at Tokyo during 23-27 October 1989.

In all, there were 575 participants from various countries like USA, USSR, UK, Canada, FRG and Japan. Prof. Mazumdar was the sole representative from India. A total of 273 papers were presented. Prof. Mazumdar presented two papers in the conference, one relating to coal structure (A new approach for the determination of the aromaticity of coal, developed as an Emeritus Scientist at CGCRI, Calcutta) and the other on the Nature of Moisture in Coal. Both have been published in the two-volume proceedings of the conference.

Earlier, Prof. Mazumdar attended Japan-Australia Workshop on Structural Characterization and Use of Australian Coals, at the Kansai University, Suita, Osaka, during 16-20 October 1989. Prof. Mazumdar was one of the 3 special invitees, other two being Prof. Eric Suuberg of Brown University, USA and Prof. Anna Marzec of Polish Academy of Science, Poland. Prof. Mazumdar presented a paper entitled 'Correlation of Physical and Chemical Properties of Coal and Coal-derived Liquids: Some Structural Commonalities'. Also, he was chairperson of one of the technical sessions. □

INSDOC's Graphic Arts and Printing Unit transferred to PID

The Graphic Arts and Printing Unit (housed in PID building) of the Indian National Scientific Documentation Centre (INSDOC), New Delhi, has been transferred to the Publications & Information Directorate, New Delhi, with effect from 1 January 1990. □

PATENTS FILED

950/DEL/89: A synergistic fire retardant composition for national rubber & its products incorporating the fire retardant composition, A.R. Menon, R. Menon and C.K.S. Pillai and A.D. Damodaran—Regional Research Laboratory, Trivandrum.

951/DEL/89: A direct reading portable atmospheric corrosion monitor, K.I. Vasu, Y. Iyer, M. Iyer, M. Sundaram, H.V. Shanbhogue, R.H. Rao, S. Bapu, S.S. Azim, A. Selvaraj—Central Electrochemical Research Institute, Karaikudi.

952/DEL/89: A method for preparation of ultrafine silicon carbide powder from cashew nut shell oil resin, A.K. De, N.R. Bose, and K.K.

Phani—Central Glass & Ceramic Research Institute, Calcutta.

953/DEL/89: A process for the synthesis of N-substituted amides of L-tyrosyl-D-alanyl-glycyl-L-N-methylphenylalanyl-glycine, K.B. Mathur, S.D. Sharma, W. Haq, B. Kundu, R. Raghubir, G.K. Patnaik and B.N. Dhawan—Central Drug Research Institute, Lucknow.

954/DEL/89: Process for the preparation of crystalline titanium silicate TS-2, J.S. Reddy, A. Thangaraj, R. Kumar and P. Ratnasamy—National Chemical Laboratory, Pune.

955/DEL/89: An improved process for the preparation of crystalline titanium silicate TS-1, A. Thangaraj, R. Kumar and P. Ratnasamy—National Chemical Laboratory, Pune. □

CSIR Technology Awards

CSIR has instituted, from this year, two sets of Technology Awards to recognize and encourage technology development and multidisciplinary team effort of CSIR scientists/institutes.

1. CSIR Technology Prize

One prize each in the areas of Biological, Chemical, Engineering and Materials Technology will be given for individual or group achievement in technology development. Each prize will consist of a citation and prize money of Rs 30,000 for the individual or group with the minimum amount receivable by a member of the group being Rs 10,000.

2. CSIR Shield for Technology

Two shields, one for processing technology and another for engineering technology will be given to CSIR groups/laboratories on the basis of excellence of their specific technological achievements in the above areas. Each award shall consist of a shield, to be held in rotation for a year by the group/laboratory winning it and a plaque, to be retained by it.

The main criterion for selection of individuals, groups or laboratories for these awards will be the visible and sustained contribution of high impact value to industrial/economic activity and its global novelty and innovative character.

Nominations to the awards will be invited from Directors of CSIR laboratories/Director-level Scientists/Chairmen of Research Councils, each year in the month of January. Nominations in prescribed pro forma (available from Coordinator, TUD, CSIR, New Delhi) should be sent to DG, CSIR, by 31 March of the year the nominations are made for. Nominators may send as many nominations as they deem fit for each award.

Selection of awards will be done by an Awards Selection Committee, to be constituted by the Advisory Board, comprising not less than six experts and a Chairman, all external to CSIR. DG, CSIR shall be a permanent invitee to the Selection Committee. Announcement of the awards shall be made with the approval of the Governing Body □

ANNOUNCEMENTS

Second National Convention of Electrochemists and First National Congress on Metallic Corrosion

The Second National Convention of Electrochemists and First National Congress on Metallic Corrosion will be jointly organized by the Society for Advancement of Electrochemical Science and Technology (SAEST), Karaikudi; National Corrosion Council of India (NCCI) and the Central Electrochemical Research Institute (CECRI), Karaikudi, from 28 February to 1 March 1990.

In order to enthuse and encourage young workers, the emphasis in this meet will be on young scientists and students. Young scientists who have distinguished themselves in their chosen field will be invited to present their achievements. A number of teachers, students, scientists and industrialists will be participating in this meet. There will be a poster session exclusively for students.

Synchronizing with this national meet, the first National Congress on Metallic Corrosion will be held on 1 March. A number of keynote papers and case studies will be presented.

Those interested to participate may please contact: Dr N.S. Rengaswamy, Secretary, SAEST, Karaikudi 623006. □

Refresher Courses/Training Programmes at CRRI

The Central Road Research Institute (CRRI), New Delhi, will be organizing the following training courses during 1990.

Course	Duration
Training programme for personnel of state traffic engineering cells	7-28 March
Refresher course in highway & bridge engineering	11 April - 13 July
Training course on use & maintenance of automatic road unevenness recorder/profilograph/bump integrator & introduction to other related devices	23-27 July
Training programme in elastomeric bearings for bridge design engineers	6-10 August
Refresher course in traffic & transportation engineering	22 August - 5 October
Senior refresher course for highway engineers	24 October - 15 November
Training programme in procedures of material testing & quality control techniques of highway construction	21 November-11 December
Training course on use & maintenance of automatic road unevenness recorder/profilograph/bump integrator and introduction to other related devices	17-21 December

Further details regarding these courses can be had from: The Director, CRRI, New Delhi 110020. □

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***Artemisia annua* L.—A valuable source of the antimalarial Artemisinin (p.26)**

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ARTEMISININ

R.S. THAKUR AND R.A. VISHWAKARMA
Central Institute of Medicinal and Aromatic Plants, Lucknow

Malaria is the World's most important infection in terms of human suffering and death. Large scale attempts to eradicate malaria from most parts of the world were initiated in 1950s. Over 30 countries were freed of malaria and its prevalence reduced markedly, but most tropical countries where malaria is endemic started experiencing a resurgence. In the early 1960s, the occurrence of chloroquine resistance in *Plasmodium falciparum*, the causative agent of the most dangerous forms of malaria, gave rise to added urgency to the development of new antimalarial drugs and vaccines. Since then, drug-resistence of the causative agent to the other alternative drugs has occurred and is spreading already, posing a serious threat in some parts of the world. To appreciate the extent of the problem, it should be recalled that in tropics and sub-tropics, malaria is widely distributed and that a global estimate of chronic and actute malaria reveals a total of 210-220 million infections annually, of which 80% are caused by *P. falciparum*. The chief agents employed for chemotherapy of malaria are chloroquine, primaquine, quinine, and dihydrofolate-reductase inhibitors such as pyrimethamine. Sulfonamides, sulfones, and tetracyclines are also used in combination. Mefloquine is to be released shortly to combat chloroquine-resistant strains of *P. falciparum*.

The discovery of artemisinin (qinghaosu, QHS, artemisinin) has heralded a breakthrough in the chemotherapy of malaria. Since ancient times, *Artemisia annua* L, a herb of compositae family has been used as a traditional Chinese medicine known as qinghao for the treatment of fever. The effective constituent was isolated by Chinese scientists in 1972 and shown to be a sesquiterpene lactone with unusual endoperoxide bridge. It has been found to be an extremely potent plasmodicidal (blood schizontocidal) agent and it has considerable promise for the treatment of drug-resistant malaria. The combination of an outstanding biological acitivity and an intriguing chemical structure having no precedent in chemical literature (artemisinin is the first ever 1, 2, 4-trioxane type of compound occurring in nature and its novel mode of action, incited worldwide interests in the development of peroxide based antimalarials—quinghaosu, its congenors and analogues. Artemisinin has been found to be active against chloroquine and multiple drug-resistant *P. falciparum* malarial parasite, particularly in cerebral malaria with a remarkably fast onset of action and fewer side effects. The chemical structure ($C_{15}H_{22}O_5$) was determined by Chinese scientists and in 1983, a total synthesis was reported by Schmidt and Hofheinz of Hoffmann La Roche, who used (−) isopulegol as starting material. The final key intermediate involved irradiation of a keto-aldehyde intermediate in presence of singlet oxygen at −78° to give hydroperoxide intermediate which on treatment with formic acid at 0°C yielded 30% artemisinin. Another synthesis was reported by Chinese scientists starting from (+)citronellal. These complex syntheses, though of great interest, do not provide the feasible method for large scale production. Hence the isolation of naturally occurring artemisinin from *Artemisia annua* remained the only source of the drug.

In view of the usefulness of artemisinin and its derivatives to treat malaria clinically, particularly in the Indian context where drug-resistant falciparum malaria is on rise and deaths occurring owing to cerebral malaria frequent, the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, launched the drug development programme for artemisinin and derivatives, in collaboration with the Central Drug Research Institute (CDRI), Lucknow. The drug-development programme included successful introduction of *A. annua* plant in India and its large scale cultivation, pilot scale isolation of artemisinin, synthesis of potent lipophilic derivative Arteether (ethyl ether of dihyroartemisinin) and other derivatives, pre-clinical, anti-malarial, pharmacological, toxicological, chronic toxicological and formulations studies. The Drugs' Controller of India has cleared arteether for clinical trials to be undertaken by CDRI. The R&D efforts made and results obtained are summarised below:

Cultivation of *Artemisia annua* L.

Artemisia annua L. plant was recently introduced in India by CIMAP from the Royal Botanical Gardens, Kew, England. Utilizing the agro-technology developed at CIMAP, *A. annua* is being currently cultivated in Kashmir valley to produce large quantities of antimalarial artemisinin. Owing to the highly cross pollinated nature of the plant, its crop raised from the originally introduced seed material exhibited a large variation for the various plant characters including maturity, leaf biomass yield and artemisinin content, causing a great instability in its artemisinin yield. To overcome these inherent problems through genetic upgrading following population-improvement (mass selection) approach, intensive efforts were

made during the last few years, which resulted in the development of a genetically improved, fairly uniform and high artemisinin yielding population from the germplasm obtained from Kew, England. In large scale trials conducted at the Regional Research Centres of CIMAP at Srinagar and Lucknow, the newly developed improved population with an average of about 29q/ha leaf dry matter yield, 0.110% artemisinin content and 3.19 kg/ha artemisinin yield established its consistant superiority over the check (original base population from Kew, England), which produced only about 18q/ha leaf dry matter containing 0.084% artemisinin (1.45kg/ha). Being fairly uniform, agronomically attractive and significantly superior by 120% over the check, the new variety has great potential for increasing artemisinin production per unit area and time. It is hoped that with the adoption of this newly developed variety of *A. annua* it would be possible to produce artemisinin at a much cheaper rate to make the country self-sufficient for meeting the requirement of this valuable life-saving drug.

Isolation of Artemisinin

Air-dried leaves and flowers of *Artemisia annua* L. cultivated at Lucknow and Srinagar were extracted with petroleum ether (60-80°C) in the batches of 50 kg dry plant material in the institute's plant. In 1986-87, a total of 3.5 tonnes of the herb was extracted with solvent in soxhlet at room temperature. In 1987-88, almost half of the total produce (8.5 tonnes) of that season was extracted. The extracts were concentrated under reduced pressure to avoid any loss of compound owing to excess exposure to heat, because the drug is heat sensitive. The concentrate of extract was defatted by methanol to decrease tha bulk of extract to be loaded on column of silica gel. The yield of extract was 10% of the dried plant material and the bulk of this extract (containing artemisinin) could be reduced to half by defatting by methanol. The methanol soluble fraction was concentrated under reduced pressure and the residue was chromatographed on a silica column, employing a specially fabricated stainless steel column. The ratio of weight of material load and silica gel was 1 : 10 for satisfactory isolation of the artemisinin. Elution of column with 10% ethyl acetate hexane mixture afforded artemisinin rich fraction which on concentration and crystallization afforded pure compound which on recrystallization with ethyl acetate/hexane gave crystalline pure needles of artemisinin, mp 153-54°C. On the pilot scale isolation, the plant material from Srinagar, afforded better yields, i.e. 0.07-0.08%. The three distinct *A. annua* strains originated from Kew Garden (England), and Washington DC and grown in the research farm of CIMAP, were evaluated for more artemisinin production.

Synthesis of Arteether

Artemisinin is sparingly soluble in water or oils and not well absorbed by gastrointestinal tract. A search for more potent analogues of artemisinin with better bioavailability was therefore made. Among all the derivatives of artemisinin investigated, arteether (ethyl ether of dihydroartemisinin) was found superior to other derivatives because of its better lipophilicity pharmacokinetic properties and considerably lesser toxicity. Arteether, therefore, was chosen as potent candidate drug for clinical trials after successful pre-clinical antimalarial, pharmacological and toxicological studies carried out at CDRI.

Arteether is prepared in two steps using batches of 10 g artemisinin to avoid any losses whatsoever of a precious natural product. Scaling-up studies are undergoing at CIMAP. The first step in the preparation of arteether involves sodium borohydride reduction of artemisinin and subsequent etherification of dihydroartemisinin by Lewis acid catalyzed reaction, affording an epimeric mixture of β- and α-ethyl ether of dihydroartemisinin (70 : 30 epimeric mixture ratio). Both the epimers have been separated by column chromatography and crystallization to yield crystalline β-arteether and oily α-arteether. The structures were determined by spectroscopic techniques.

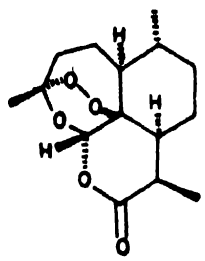
Stereoselective preparation of α-arteether: A new and efficient process for the preparation of α-ethylether of dihydroartemisinin has been developed and a process patent filed in India. The process gives an easy access to α-arteether only, which being oil itself, is easily soluble in groundnut oil, the vehicle for intramuscular injection.

Antimalarial Activity of Artemisinin and Arteether

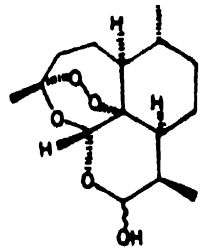
Antimalarial activity of artemisinin (quinghaosu) and arteether against blood induced *Plasmodium berghei* infection was evaluated in Swiss mice. Artemisinin in doses ranging from 3.12 to 100 mg/kg (administered intramuscularly as aqueous suspension) for 4 days did not have any suppressive effect. When it was given in neutralized groundnut oil (Arachis oil), a dose of 100 mg/kg × 7 days was fully curative. Arteether showed 80% curative action when single or two doses of 5 mg/kg drug were given in oil, intramuscularly. Three dose treatment at 5 mg/kg was fully curative against sensitive strain of *P. berghei*.

Blood schizontocidal activity of epimers of arteether (α-arteether and α/β-arteether (30:70) has been evaluated against a multi-resistant strain of *P. yoelii nigeriensis* in weanline rats. Both the drugs were dissolved in sterile groundnut oil and administered intramuscularly. α/β-Arteether has shown curative action at 2.5 mg/kg × 3 doses in rats while α-arteether was consistently curative against above infection at 5 mg/kg × 3 doses.

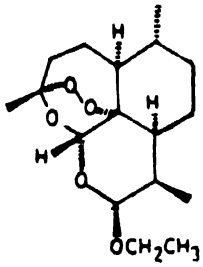
Arteether was found to have curative action at 5 mg/kg × 3 days



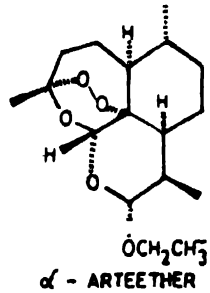
ARTEMISININ (QINGHAOSU)



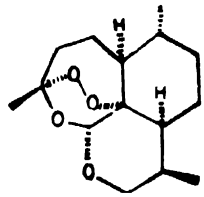
DIHYDROARTEMISININ



β - ARTEETHER



α - ARTEETHER



β/α - ARTEETHER (70 30)

CANDIDATE DRUG

against blood-induced *P. cynomolgi* B infection in rhesus monkeys, while the curative dose of artemisinin oil suspension was 10 mg/kg × 7 days or 20 mg/kg × 3 days. Parasite clearance with arteether was achieved within 24 h. Neither arteether nor artemisinin exhibited any casual prophylactic or radical curative action up to a dose of 20 mg/kg against sporozoite-induced *P. cynomolgi* B infection in rhesus monkeys. A multiple drug resistant strain of *P. yoelii nigeriensis*, resistant to mefloquine (128 mg/kg × 6 days), quinine (30 mg/kg × 7 days) and chloroquine (64 mg/kg × 8 days) was found to be completely susceptible to arteether at a dose of 5 mg/kg × 3 days administered intramuscularly. Artemisinin at 50 mg/kg × 7 days had only suppressive action against this strain.

Gametocytocidal activity of artemisinin has been demonstrated against simian malarial parasite *P. cynomolgi* B. Colony-bred *Anopheles stephensi* were allowed to feed on gametocyte carrying rhesus monkeys and the mosquito infectivity rate and ocyst count of the infected mosquito gut were recorded on day 8-9 post infection. Control (pretreatment) feeding of mosquitoes on gametocyte-carrying monkeys showed good infectivity (57.15-95%) in different batches of the mosquitoes. Administration of single intramuscular injection of 5 mg/kg artemisinin (suspended in neutralized oil) resulted in complete loss of mosquito infectivity within 24 h of drug administration. This is the first report on the possible use of artemisinin to stop malaria transmission. The drug had no sporontocidal action. Arteether showed significant gametocytocidal activity at 2.5 mg/kg (single dose, intramuscular) against *P. cynomolgi* B as shown by complete absence of mosquito infectivity. No sporontocidal action was demonstrated in the vector up to a dose of 25 mg/kg (i.m.).

Anti-malarial activity of α/β-arteether, particularly the blood schizontocidal activity, has been tested in two species each of malaria in mice and rhesus monkey. The initial test indicated antimalarial efficacy of arteether against blood stages of *P. berghei*. The drug was given intramuscularly on day 0, +1 and +2 and the curative dose was found to be 5 mg/kg × 3 days. The strain of *P. yoelii nigeriensis* used in this study showed resistance to oral administration of mefloquine, quinine and chloroquine. A minimum dose of 5 mg/kg × 3 days (intramuscular) was curative and recrudescence of parasitaemia was not observed. Further studies showed that curative dose of arteether against *P. yoelii nigeriensis* in albino rats was 2.5 mg/kg × 3 days. Initial studies showed that a dose of 20 mg/kg × 7 days was curative against *P. cynomolgi* B in the rhesus monkey and no recrudence was observed up to 50 days of observations. Further studies showed that even lower dose of 5-7.5 mg/kg × 3 days was fully curative against blood induced *P. cynomolgi* B infection. Arteether is curative at 12 mg/kg × 3 days against acute infection with *P. knowlesi* in rhesus monkeys which were in precoma stage. The drug was curative even at higher parasitaemia ranging from 10 to 30%. These results suggested that arteether is effective in controlling acute malaria infections and a potential drug for the treatment of cerebral malaria.

Pharmacological Studies

Pharmacological studies on artemisinin have been carried out in experimental models by giving the drug as oil suspension intramuscularly. Doses ranging from 30-200 mg/kg of artemisinin were devoid of significant pharmacological effects on central nervous system, cardiovascular system and urinary system. The drug has not shown any anti-inflammatory or antiallergic

activity. No adverse pharmacological effects have been observed in this study.

Pharmacological studies on arteether were conducted at CDRI, on various experimental models. These included changes in gross behavioural effects at 215-1000 mg/kg dose, analgesic activity at 200 mg/kg anti-passive cutaneous anaphylactic activity at 50-100mg/kg dose in mice, changes in blood pressure, respiration, ECG and nictitating membrane contraction in anaesthetized cats at 3-35mg/kg dose, diuretic activity at 100mg/kg and anti-inflammatory activity at 50mg/kg dose in rats. The above doses of arteether were devoid of any significant pharmacological effects on central nervous system, cardiovascular system and urinary system. Further, the drug had no anti-inflammatory response or anti-allergic activity, though it demonstrated some anti-anaphylactic activity at higher doses.

Toxicity Studies

Toxicity studies with α/β-arteether were undertaken at CDRI and the results obtained are as follows:

Acute toxicity: The LD_{50} in mice was 1000 mg/kg (i.m.)

Sub-acute toxicity: The results of sub-acute toxicity study conducted in rats and monkeys are as follows:

Rats: Toxicity test consisting of daily intramuscular injections of arteether in arachis oil, 3-consecutive days-a-week for 4 weeks, in doses of 2.5, 5.0 and 10.0 mg/kg body weight in different groups of rats did not show any adverse effect on the animals. The controls were injected with comparable volumes of arachis oil alone. Experiment was terminated by sacrificing the animals two weeks after the last course of injections. Findings of haematology, biochemistry and histology were found to be well within the range of normal.

Monkeys: Toxicity tests consisting of daily intramuscular injections of arteether in arachis oil, 3 consecutive days-a-week for 4 days, in doses of 7.5, 15, and 30 mg/kg body weight in different groups of rhesus monkeys showed no adverse effect on the animals.

The controls were injected with comparable volumes of arachis oil alone. The experiment was terminated by sacrificing the animals two weeks after the last course of injections Finding of haematology, biochemistry and histology were found to be well within the ranges of normal. Arteether has been found safe in rats and rhesus monkeys in the doses mentioned above.

Future Plan and Prospects

The candidate drug arteether is currently under clinical phase I trials which include study of single and multiple dose tolerance in human subjects. The clinical phase II/III trials would be undertaken on the patients not responding to chloroquine and patients of complicated malaria such as cerebral malaria. The crop-improvement programme for high yielding *A. annua* variety and the development of a cost effective chemical processing technology are currently being actively pursued at CIMAP. Synthesis of new and water soluble derivatives of artemisinin for oral/intravenous administration and development of new formulation have already been initiated. Since this class of drugs are totally novel in structure and activity, the structure-activity relationship and mode of action studies are also a desirable objective. □

Dr A.P. Mitra, Director General, CSIR, inaugurates Permanent S&T Exhibition on Environment at NEERI

Dr A.P. Mitra, Director General, CSIR, inaugurated a permanent S&T exhibition on 'Environment', at the National Environmental Engineering Research Institute (NEERI), Nagpur, during his one-day visit to the institute on 17 November 1989.

The exhibition covers major R&D thrust areas in the field of environmental science and engineering at NEERI. These are: Environmental Monitoring including Remote Sensing Applications; Environmental Systems Modelling & Optimisation; Environmental Systems Design; Environmental Impact & Risk Assessment, Environmental Policy Issues; Environmental Biotechnology; Water Technology Mission and Ganga Action Plan.

Prior to his visit to Nagpur, Dr Mitra visited the floating laboratory, 'Feromina Harvest' at Bombay on 16 November, to be used by NEERI scientists engaged in comprehensive environmental impact studies at ONGC oil gas fields in the Arabian Sea. He inaugurated the floating laboratory before its formal sail-off to high seas. □

Different Aspects of Food & Food Processing

Dr B.L. Amla, delivers lecture at CSIR Complex, Palampur

Dr B.L. Amla, Director, Central Food Technological Research Institute (CFTRI), Mysore, delivered a lecture on 'Different Aspects of Food & Food Processing' at the CSIR Complex, Palampur, on 26 December 1989, to a gathering of scientists of the CSIR Complex, local agriculture university and other distinguished guests. In his lecture, he defined food as a stored form of solar energy. He said that seasonability and limited durability of natural foods which are not always

Dr B.L. Amla delivering his lecture on Different Aspects of Food & Food Processing

available in a readily usable form, have led to the discovery of food processing techniques. The advent of modern energy sources and urbanization has brought a revolutionary change in food processing industry. Change in the role of women, especially in the urban society, has brought about a transition from traditional kitchen practices to commercial production of food, because commercial food is cheaper than the domestic food in most of the countries. In the past few years, there has been an increase in ready-to-cook and ready-to-use food products in the market. While explaining the extrinsic and intrinsic parameters of food, Dr Amla stressed that apart from proper taste and nutrients, food should possess pleasing colour and flavour. □

Floriculture in India, Dimension of Research and Development in 21st Century

Dr R.M. Pandey delivers lecture at CSIR Complex, Palampur

Dr R.M. Pandey, Commissioner, Horticulture and Executive Director, National Horticultural Board, Government of India, delivered a talk on 'Floriculture in India, Dimensions of Research and Development in 21st Century', on 27 November 1989 at the CSIR Complex, Palampur. In his lecture, Dr Pandey stressed the importance of ornamental horticulture in India from aesthetic, environmental and economic points of view. Discussing the constraints of the Indian floriculture industry, Dr Pandey suggested latest agrotechnologies, better financing, easy import-export regulations, extension support, formation of co-operatives and establishment of cool room facilities at airports, for bringing about the improvements in the industry. □

Mr Prosper Higiro, Director of Planning, Department of Small and Medium Industries, Government of Rwanda, visits PTC (Hyderabad)

Mr Prosper Higiro, Director of Planning, Department of Small and Medium Industries, Ministry of Industries and Artisans, Government of Rwanda, Kigali, Rwanda, visited the CSIR Polytechnology Transfer Centre (PTC), Hyderabad, on 17 November 1989 to seek advice and guidance on planning of industries in Rwanda.

Rwanda is a land-locked country whose 90% population is mainly engaged in agriculture. Its most important crop is coffee and the most important mineral resource is cassiterite (tin ore). The Ministry of Industries in Rwanda was created only in 1984 and they are still engaged in preparing the plan document. The broad government policy is to promote small and medium scale industries and the function of the Planning Department is to evolve appropriate strategies in achieving this objective. It was in this direction that the Rwanda official wanted PTC, Hyderabad's help.

Prof. B.R. Sant, Scientist-in-Charge, PTC-Hyderabad, suggested various approaches to industrial planning such as: (1) Create awareness about the need for industrial development vis-a-vis resources; Identify agro-based and non-agro-based industries, Identify existing and traditional industries that need improvement/ modernization/ indigenization; Plan sectoral development of industries—tiny, cottage, small and medium and Project the planning exercise to a specific period, say five years; Identify smallest manageable administrative unit (called 'cell' in Rwanda) for industry planning; Emphasize on the development of technical skills and introduction of self-employment schemes, expecially amongst rural women; and Laiase with other government departments for development of infrastructure, communication systems, and manpower.

Mr Higiro expressed his deep appreciation for the advice of PTC (Hyd.), which, he felt, will help in preparing plans for the development of small and medium scale industries in his country. □

US Science Attache and NIH Scientists visit CDRI

A delegation consisting of the following members visited the Central Drug Research Institute (CDRI), Lucknow, on 2&3 November 1989: Dr D.L. Madden, Science Attache, US Embassy in India, New Delhi; Dr Marcus A. Hairstone, VAP Secretariat, Fogarty International Centre, National Institutes of Health, Bethesda, Maryland; Dr John W. Diggs, Director, Division of Extramural Activities, National Institute of Allergy and Infectious Diseases (NIAID), NIH, Bethesda, and Dr Olivia T. Preble, Acting Chief, Microbiology and Immunology Review Section, Programme and Project Review Branch, Division of Extramural Activities, NIAID, NIH, Bethesda.

Dr B.N. Dhawan, Director, CDRI, welcomed the delegation and briefed the members on the R&D activities of the institute. The US scientists showed keen interest in the institute's programme on communicable diseases like malaria. The delegation had a lecture-cum-discussion

Prof. B.N. Dhawan delivering his welcome address. Seated on the dais (from left) are: Dr (Mrs) Oliva T. Preble, Dr Marcus A. Hairstone, Dr D.L. Madden and Dr John Diggs

programme on the 'Review procedures for NIH research grant applications'. During the lecture session, attended by senior scientists of the institute, Dr Madden introduced the NIH scientists Dr Hairstone, Dr Diggs and Dr Preble who presented a detailed view of the areas funded by NIH, the procedures involved in processing of grant applications and the peer review systems and the extent of extramural funding available to scientists and research institutions. The lectures were followed by discussions on the priority areas available for funding by NIH and the possibility of NIH support to some of the CDRI research programmes.

The delegation also visited the Regional Sophisticated Instrumentation Centre (RSIC) located at CDRI and saw the facilities like NMR-400 MHz, HPLC, GLC microanalysis lab, electron microscopes and liquid nitrogen plant and the in-house back-up facilities available for repair of sophisticated instruments.

The delegation also visited the Division of Microbial Genetics and the Primate Facility at the Animal House and had discussions with the scientists. □

Optical Fibre Telephone System installed at Malkera Colliery, Dhanbad

The Central Glass & Ceramic Research Institute (CGCRI), Calcutta, has successfully produced doped high-silica glass preforms using the conventional MCVD process.

Fibres of standard dimensions (50 μm core, 125 μm clad) with acrylate resin coating were prepared from these preforms. With the help of Hindustan Cables Ltd, about 9.1 km of optic fibre was jacketted with thixotropic jelly filling and cabled with polythene sheathing in duplex, 6-core and 8-core configurations. The ends of the cabled fibres varying in length from 70 to 1.15 km were connectorized in CGCRI, and tested for audio and video signal transmission. With the

Optic fibre cable drum and surface exchange telephone set T_8. Telephone system at communication site T_3 in operation

help of adapters and the 6-fibre and 8-fibre cable pairs, the links were extended to the pit top surface (374 ft above the 16 seam pit bottom) of Malkera Colliery, Dhanbad, for final connection to a manually operated switching exchange along with two additional surface links. For operating mode, all the points from bottom to the exchange and bottom to bottom were connected directly through manual switch at the surface exchange.

The present 10-point optical communication system is the first analogue mine network developed indigenously by three CSIR laboratories, viz. CGCRI, Central Scientific Instruments Organisation, Chandigarh, and Central Mining Research Station, Dhanbad. The system was inaugurated at a simple function at the above colliery on 12 November 1989, in the presence of the three Directors of the collaborating laboratories. □

PROGRESS REPORTS

CCMB Annual Report: 1988-89

The scientific attainments of the Centre for Cellular & Molecular Biology (CCMB), Hyderabad, during 1988-89, according to its annual report for the year, were as follows:

Genetics of osmoregulation : As part of ongoing studies on water stress-adaptation in a model biological system (the bacterium *Escherichia coli*), the gene organization and complete nucleotide sequence of an operon encoding a proline/betaine transport system proU, was determined. This work represents the first example in Biology in which a detailed molecular understanding of an important osmoregulatory function has been achieved.

New and better probes for DNA fingerprinting, sexing of the individual cell and detecting novel genetic aberrations : The technique of detecting a DNA pattern, unique to each person like his fingerprints, is known as DNA fingerprinting. Isolation by the CCMB scientists of a class of repetitive DNA from the females of the poisonous species of Indian snake, Banded Krait, as a minor satellite DNA component, designated as Bkm, was reported earlier. These sequences are highly conserved in eukaryotes. Because of the association of Bkm sequence with the sex-determining chromosomes, *Drosophila melanogaster* (fruit fly) and human genomic libraries were screened with a radio-labelled Bkm probe. Several clones were isolated, new probes developed and improved methods for DNA fingerprinting worked out for the sexing of an individual cell and detecting novel genetic aberrations, which could be made available for use in defence records, in crime investigation and family matters, in IVF (*in vitro* fertilization) centres for sexing of preimplantation embryos, in producing test-tube babies of desired sex (particularly in the case of sex-linked genetic disorders), in medical diagnosis, in pedigree analysis, and in detection of novel genetic disorders related to sex chromosome associated abnormalities.

Hypersensitive bonds in proteins : When yeast alcohol dehydrogenase gets degarded on storage at 37°C for 24-48 h, almost all the degradation products obtained have glycine at the amino terminal. This observation indicates that certain sequences—perhaps tripeptide sequences which have glycine in position 1, 2 or 3—are more susceptible to degradation than others. Sequencing of the peptides obtained following degradation of the above enzymes by a neutral protease, isolated earlier by CCMB from bovine seminal plasma, showed that this protease also acts on sites which have glycine. These sites appear to be similar to those at which degradation on long-term storage in the absence of the enzyme occurs. This observation supports the view that the protease from seminal fluid recognizes the hypersensitive peptide bonds and that these bonds are next (or close) to a glycine residue.

Seminalplasmin : Seminalplasmin was shown to inhibit the binding of anti-CD-4 antibodies to the surface of CD-4 antigen carrying T lymphocytes. Since the CD-4 antigen on the surface of T helper cells acts as a receptor for the AIDS virus, these observations strongly suggest the possible use of seminalplasmin as an anti-AIDS agent. Seminalplasmin was also shown to lyse dividing cells but not resting cells; it could thus be used as a marker to distinguish between resting (G_0) cells from the cells which are in the cell cycle.

Ribonuclease and RNA turnover : Mammalian liver is known to possess several ribonuclease (RNase) activities. One such RNase, namely RNase II, is distributed in various subcellular fractions and may be present in an inactive or latent form or as an active enzyme. RNase II in the liver cytosol is present virtually entirely in the latent form complexed with a protein inhibitor. The activation of this inhibitor-bound enzyme is considered to play a key role in cell metabolism. To understand the mechanism of this process, experimental conditions which result in cellular activation of this enzyme were worked out; isolated rat-liver perenchymal cells and liver tissue after partial hepatectomy were found to possess RNase activity at levels consistent with cellular activation of the latent enzyme. The enzyme from isolated liver cells was purified, characterized and identified as the one involved in the RNase-inhibitor system in liver; the activity in the soluble protein extracts from the liver tissue following partial hepatectomy also appeared to be an analogous activity.

Mechanism of transcription : The antibiotic rifampicin is known to be an inhibitor of the initiation of transcription of *E.coli*; it binds strongly to the β−subunit of *E. coli* RNA polymerase. The inhibitory effect of rifampicin was shown to be varying widely with different promoters of mRNA and rRNA, and depending largely on the nature of the 5′-initiation site of the transcript. The geometric relationship between the

rifampicin-binding site and the substrate-binding site on *E. coli* RNA polymerase was also mapped.

Protein transport into the nucleus: The selective entry of proteins into the nucleus of a eukaryotic cell requires the presence of a nuclear-location signal sequence within the protein. A photolabelled derivative of a synthetic octapeptide single sequence for the SV40 T antigen, was used to identify specific binding proteins in the nucleus which may be necessary for the nuclear transport of proteins. An *in vitro* nuclear transport system was developed in which plasmid-derivative mRNA could be translated *in vitro* and the synthesized proteins selectively transported into purified nuclei.

Mechanism of cataract formation: A very common affliction of the eye is the formation of a cataract. When cataract forms, the eye lens is no longer transparent and becomes opaque, leading to sight deficiency. A new method was derived for studying the changes that happen to the intact eye lens during cataract formation, directly, using fluorescence properties of the protein that constitute the lens. Cataract is generated in the eye lens by shining ultraviolet light or by other chemical methods. It was found that clearing mechanisms exist in the lens that lead to the reduction or total avoidance of the damage (for example, by ultraviolet light) that leads to cataract. In cataractuous lens, such clearance mechanisms become inoperative.

Fate-mapping of cells during development: During embryonic development, the fertilized egg undergoes a complex series of changes involving cell division, differentiation, migration and morphogenesis. An important question which is central to these changes is how and when do progenitor cells become restricted to a developmental pathway, i.e. how are lineages determined. In an attempt to answer the question of lineage specification in mouse embryonic development, the bacterial ß-galactosidase gene was introduced under the SV40 promoter and nuclear location signal, into pluripotent mouse embryonal stem cells. Clones expressing this gene were microinjected into 41-day old mouse embryos, and successfully reimplanted into recipient female mice. Several chimeric offsprings were obtained. These chimeras would be invaluable in investigating the lineages in various tissues of the adult organism.

Mechanism of heat shock: All living organisms respond to evironmental stress, including heat, by synthesizing a set of new proteins. It was shown that the proteins which are constitutively expressed in the adult are induced in the embryonic tissues by heat shock. Specifically, albumin, a major adult liver-specific protein was found to be induced by giving heat shock to the embryonic cells. At the same time, the synthesis of alfafetoprotein, which is present in embryonic cells and the synthesis of which stops when albumin appears, ceases upon the premature appearance of albumin. This suggests that the developmental controls that reciprocally regulate the synthesis of alfafetoprotein and albumin operate at an early stage on giving heat shock to embryonic cells. The intracellular *p*H of liver cells was measured. The internal *p*H of the embryonic liver cells increased by 0.2 when cells were given heat shock. Chemicals that induce a change in the internal *p*H of the cells, induced the synthesis of albumin at normal temperature. These results suggest that the synthesis of albumin in embryonic cells is probably due to a change in the intracellular *p*H caused by heat shock.

AK-5 macrophage tumour: AK-5, a rat macrophage transplantable tumour, established earlier in CCMB was shown to contain an albumin like protein on its cell surface, that acts like a tumour-specific transplantation antigen. The tumour appeared to be due to murine leukemia virus.

Mechanism of action of the oncogene product, the ras protein: The stimulation of phosphorylation by *ras* proteins of a 38-kD membrane protein (p38) from rat liver cells was reported earlier. It was found that angiotensin II, epidermal growth factor, glucagon

Circular dichroism spectrometer at CCMB, Hyderabad

and vasopressin enhance the phosphorylation of p38 by *ras* in a guanine nucleotide-dependent manner. This stimulation of a phosphorylation of a membrane protein by *ras* and G-proteins is the first observation of its kind.

Tumour heterogeneity : In the course of the work at CCMB on the regulation of cell division in the Zajdela ascitic hepatoma it was shown that the slow-growing and regressively tumourogenic L cells express only low levels of the cell cycle-specific thymidine kinase (TK) enzyme as compared to the rapidly growing and tumourogenic H cells which show very high levels of the TK enzyme. It was also shown that two kinds of mRNA for TK are expressed in the H cells. The significance of this novel mechanism for the regulation of the expression of the TK gene was being investigated.

Chromosome separation : A technique was established for making chromosome suspensions from tumour cells for carrying out flow sorting of the marker chromosome from the tumour cells.

Microorganisms of Antarctica : Taxonomy of the bacteria and yeast of Schirmacher Oasis, Antarctica, was completed. The dominant bacteria were found to be *Pseudomonas fluorescens, P. putida, P. syringae, Flavobacterium multivorum, Micrococcus roseus, Planococcus* sps. and *Arthrobacter* sps. The yeasts were identified as *Candida humicola, C. famata, C. ingeniosa, C. auriculariae, Bullera alba* and *Rhodotorula rubra.* Plasmids were detected in 30% of the above bacteria.

Internuclear connections : Internuclear connections (INC) were observed for the first time in splenocytes of various animal species by high-voltage electron microscopy (HVEM). INC were found to be tissue specific; only about 10% cells showed such connections. INC were seen only in one sub-set of the T cell population; they were absent in nude mice in which tymus was missing. HVEM studies revealed that in these connections the nuclear membrane invaginates and forms a tubular structure which traverses through the cytoplasm and plasma membrane and joins a similar structure coming from the other nucleus. Very large, well extended and branched INC were seen in splenocytes of pregnant animals. Such branched connections could also be seen in placental homogenate and progestrone-primed male animals. These connections may play a role in bringing down the immune response of the body during pregnancy, to aid the implementation of the embryo.

Mathematical modelling of biochemical reactions : Mathematical models of genetic and metabolic reactions in cell can help in understanding cellular functions and in predicting new and desired properties. A realistic model for the tryptophan operon in bacteria was studied and feasible conditions (i.e. mutations) for over-producing this amino acid were obtained. Tryptophan being an essential amino acid, this study may help in its biotechnological production. A model for general metabolic network involving common biochemical mechanisms such as end-product inhibition and enzyme activation, showed a variety of behaviours—stal le, periodic and chaotic. This shows that even simple biochemical systems can enter or exist in a chaotic state under certain conditions. This would explain the aperiodic or random behaviour observed in many cellular functions under both normal and pathological conditions.

A new assay for alkaline phosphatase : An assay for alkaline phosphatase that is about 12 times more sensitive than the conventional assay was developed. The usefulness of this assay in studying dynamics and energy requirements of alkaline phosphatase in *E. coli* was demonstrated.

Synthetic peptides : A synthetic peptide corresponding to the hydrophobic aminoterminal region of the toxin paradaxin was shown to have membrane-modifying properties similar to the parent toxin. □

Electron microscope facilities at CCMB, Hyderabad

NEW PUBLICATIONS

Directory of Indian Processed Food and Allied Industries

The Central Food Technological Research Institute (CFTRI), Mysore, will be shortly releasing the above

directory which includes: a list of over 4000 major food processors/exporters in the area of fruits, vegetables, bakery and confectionery, dairy, fish, meat and poultry, additives, packaging, etc. It also covers: food laws and regulations; finance, license and quality control agencies; training organizations. R&D agencies and other development agencies. It is divided into six major parts, i.e. (1) Processed Food Industries, (2) Allied Industries, (3) Exporters, (4) Industrial Production and Regulation Agencies, (5) Indian Food Laws, Regulations and Specifications, and (6) Appendices.

This 752-page directory is intended to serve as an invaluable guide to food processors, traders, exporters and others who wish to have an overview of the food processing sector. For easy reference, the entries are arranged alphabetically giving name of the manufacturer/exporter, address, products (trade names), phone numbers and telegraphic code. An index giving information on range of products, flavours and additives available in the country has also been appended.

Copies of the directory [Price Rs 500 + Rs 25 (packing and postage)] can be had from the Sales and Distribution Officer, FOSTIS, CFTRI, Mysore 570013. D.D./M.O./Cheques should be in the name of Director, CFTRI, Mysore. Outstation cheques should include Rs 10 extra towards bank charges. □

TRAINING COURSES

Awareness Programme on Water Desalination

The Seventh Awareness Programme on Water Desalination for Public Health Engineers nominated by various state governments was conducted at the Central Salt & Marine Chemicals Research Institute, Bhavnagar, from 13 to 15 December 1989. The programme was sponsored by the Department of Rural Development, Ministry of Agriculture, Government of India. Seven engineers attended the programme which comprised lectures on reverse osmosis, electrodialysis and solar distillation techniques. The participants were given demonstration on the above three desalination technologies. A trip was arranged to Awania near Bhavnagar, where solar distillation plant of 5,000 litres/day capacity is in operation since the last 12 years. A photovoltaic electrodialysis unit in operation at Awania was also demonstrated to the participants. □

DEPUTATION BRIEFS

Dr M.K. Bhashyam

Dr M.K. Bhashyam, Central Food Technological Research Institute (CFTRI), Mysore, was deputed to attend the Training Programme in Rice Processing, held in Moscow during 26 September-15 December 1989. This was an advanced training course for the specialists in rice processing, from developing countries. It was held jointly by United Nations Industrial Development Organisation (UNIDO) and the USSR Government. The programme was designed to upgrade theoretical knowledge of participants and to provide them with practical experience in the field of rice processing equipment and technology. Group discussions, presentation of country papers, project reports were also included in the programme. Also, excursions were arranged to the institutions connected with breeding, processing and storage of rice. The participants were also taken to farms, agricultural museums and processing enterprises at Leningrad, Tashkent, Krasnodar, Sochi & Urgench.

The training provided an excellent opportunity to the CFTRI scientists to see large scale handling, drying, storing and milling operations of rice, packaging of clean rice, technology of production of baby food based on pesticide free rice and feed grade yeast (protein content 35%) based on rice husk maize cob and raw dust. Rice mill managers at Krasnodar and Tashkent and Minister of Food, Tashkent, evinced keen interest in the CFTRI technologies on rice bran stabilization, oil extraction, parboiling, steam curing, flaking and rice based snack foods. □

Dr S.V. Chandra

Dr Satya V. Chandra, Scientist F, Industrial Toxicology Research Centre, Lucknow, visited Geneva, from 26 November to 2 December 1989 on invitation from IPCS/WHO to participate as member of the task group to evaluate the human health risks from exposure to cadmium. The draft on Environmental Health Criteria on Cadmium was reviewed and the document was redrafted after discussions. Summary and recommendations for further research were prepared for inclusion in the document. □

Dr K.S. Yajnik

Dr K.S. Yajnik, Head, CSIR Centre for Mathematical Modelling & Computer Simulation (C-MMACS), National Aeronautical Laboratory (NAL), Bangalore, visited USSR under the Indo-Soviet Integrated Long Term Programme (ILTP) during October 1989, to attend the Fifth Conference on Liquid State Turbulence, of the European Physical Society (EPS), held in Moscow during 16-21 October 1989. The conference was organized in the memory of A.N. Kolmogorov, the Soviet mathematician, who is famous for his contributions to probability theory and turbulence. Dr Yajnik delivered an invited lecture presenting the results of recent work at NAL on the evolution of a wall turbulent flow from a free turbulent flow.

Dr Yajnik was also invited to participate and give a lecture in the Soviet-American Workshop on Computational Aerodynamics (SAWCA) held in Tashkent during 23-27 October 1989.

During his visit, Dr Yajnik held discussions with Soviet scientists on collaboration in certain areas of mathematical modelling. □

PERSONNEL NEWS

Appointments/Promotions

At the Indian Institute of Chemical Biology (IICB), Calcutta, Dr H.K. Majumdar has been promoted on assessment as Scientist EI [Gr. IV(3)] with effect from 22 Oct. 1987, and Dr (Smt) Ujjala Dasgupta and Dr Syamal Roy have been appointed as Scientists C [Gr(IV) 2] with effect from 1 & 2 Jan. 1990, respectively. □

Honours & Awards

Dr C.L. Verma

Dr C.L. Verma, Scientist EII, Central Building Research Institute (CBRI), Roorkee, has been awarded the Annual Khosla Research Commendation Certificate for 1989 by the University of Roorkee, Roorkee, for his paper entitled 'Performance Estimation vis-a-vis Design of Mixed-feed Lime Shaft Kilns.'

Dr Mukul Kumar Basu

Dr Mukul Kumar Basu, Scientist EI, Indian Institute of Chemical Biology, Calcutta, has been elected as a Fellow of the Royal Society of Chemistry, London,with effect from 17 November 1989 and authorized to use the style and title 'C Chem. FRSC.'

Prof. A. Rahman

Prof. A. Rahman, Former Director of the National Institute of Science, Technology and Development Studies (NISTADS), New Delhi, has been appointed as Honour Professor, for five years, by the China Academy of Management Science, in recognition of his research contribution in science policy and planning and science and society interaction.

• • •

Dr R.S. Thakur

Dr R.S. Thakur, Director, Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, has been nominated as member of the following societies/committees: Governing Body of Central Council for Research in Homoeopathy, Delhi; Working Group on Drugs & Pharmaceuticals (Planning Commission), New Delhi; Working Group on Agricultural Research & Education for the formulation of the VIII Five Year Plan (Planning Commission), New Delhi; and Executive Committee, International Association for Medicinal Forest Plants (IAMFP), New Jersey, USA. □

Retirements

Dr V.N. Chhibber and Shri G.B. Kale

At the Publications & Information Directorate, New Delhi, Dr V.N. Chhibber, Scientist EII and Shri G.B. Kale, Scientist EI, retired with effect from 31 January 1990. □

PATENTS FILED

956/DEL/89: A process for the preparation of crystalline metallosilicate material, V.P. Shiralkar, A.N. Kotasthane, A.J. Chandwadkar, S. Sivasankar and P. Ratnasamy—National Chemical Laboratory, Pune.

957/DEL/89: A process for the preparation of catalyst composite material, K.S.P. Rao, S. Sivasanker, P. Ratnasamy and K.M. Reddy—National Chemical Laboratory, Pune.

958/DEL/89: A process for reforming of pyrolysis naphtha, K. Sai Prasad Rao, S. Sivasanker and P. Ratnasamy—National Chemical Laboratory, Pune.

959/DEL/89: A process for the preparation of vapour phase inhibitor suitable for protection of ferrous materials from atmospheric corrosion, I. Singh, K.P. Mukherjee and M.N. Singh—National Metallurgical Laboratory, Jamshedpur.

988/DEL/89: A process for conversion of natural gas to ethylene, V.R. Choudhary, S.T. Chaudhari and A.M. Rajput—National Chemical Laboratory, Pune.

773/DEL/89: A process for the production of synthetic liquid fuels with high yield of middle distillate fraction from synthesis gas, employing a specially prepared form catalyst, S. Basu, G. Nandi, S.B. Basu, U. Bhattacharjee, V.A. Krishna Murthi and R. Haque—Central Fuel Research Institute, Dhanbad.

795/DEL/89: A direct reading device for measuring resistivity of particulate coke or allied carbonaceous materials, A.K. Ray, M.C. Das, S.K. Majumdar and R. Haque — Central Fuel Research Institute, Dhanbad.

796/DEL/89: Process of preparing a low molecular weight, cellulase free xylanase from an alkalophilic thermophilic bacillus species, J.V. Hinge, A.P. Shendye, M.C. Srinivasan and M. B. Rao — National Chemical Laboratory, Pune.

797/DEL/89: An electronic capacitive ballast fluorescent and other discharge lamps, C.S.P. Kumar and B. Ravikrishnan—National Physical Laboratory, New Delhi.

829/DEL/89: A process for the preparation of 2-amino-1-phenyl-L-propanol (phenylpropanolamine B.P.), P.M. Subramanian, S.K. Chatterjee and M.C. Bhatia—Central Drug Research Institute, Lucknow.

850/DEL/89: Modified recoverable roof bolt, N.M. Raju, B.N. Mishra, L.M. Prasad, V. Venkateswarlu and B. Singh—Central Mining Research Station, Dhanbad.

853/DEL/89: Telescopic steel prop with hydraulic setting device, N.M. Raju, S.N. Maity, R. Sahu, B. Singh, V. Venkateswarlu and B.N. Mishra—Central Mining Research Station, Dhanbad.

854/DEL/89: Quick setting steel chock, N.M. Raju, L.M. Prasad, S.P. Sinha, B.M. Mishra, V. Venkateswarlu, B. Singh and R. Sahu — Central Mining Research Station, Dhanbad. □

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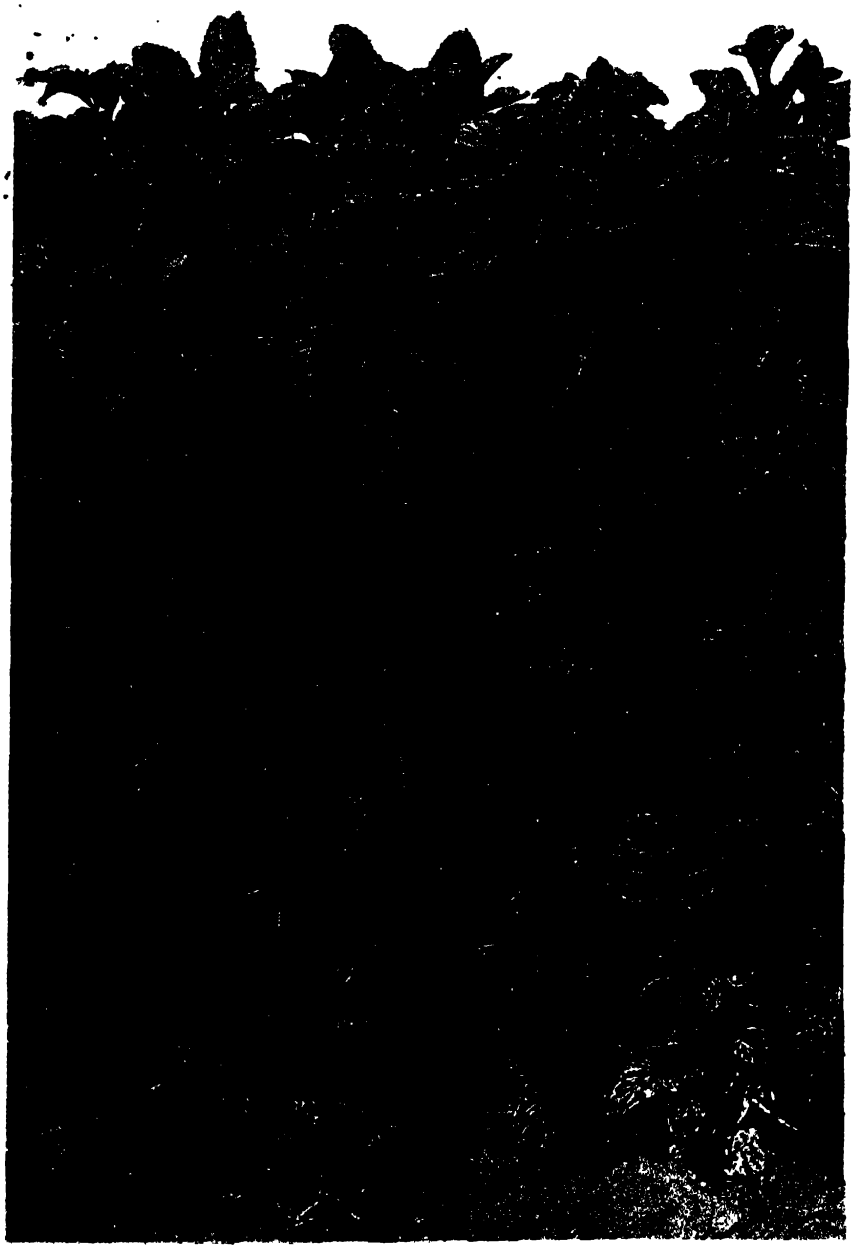

***Mentha citrata* var. *Kiran* developed by CIMAP, Lucknow. A summary of the annual report (1988-89) of CIMAP appears on p. 44**

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International Conference on Luminescence

The Central Electrochemical Research Institute (CECRI), Karaikudi, organized a three-day International Conference on Luminescence during 12-14 January 1990. More than 100 delegates, including 32 from abroad, participated in the conference which was co-sponsored by ICTP, Italy; IFCPAR, Delhi; CSIR, DST, DRDO and others. It was inaugurated by Dr V.S. Arunachalam, Scientific Adviser to the Defence Minister and was presided over by Prof. S.K. Rangarajan, Director, CECRI. Dr R.P. Rao, Convener of the Conference, welcomed the gathering.

In his address, Prof. Rangarajan highlighted CECRI's work on high efficiency fluorescent lamps, phosphors for colour television screens, radiographic imaging, luminescent paints and electroluminescent panels, and said that India, with rich rare earth deposits, could become a leader in rare earth based phosphor production. CECRI had been successful in working out technologies for the production of lanthanum related rare earth elements and the institute was expected to play an even more meaningful role in future, in the field of electrochemistry related to rare earths.

Dr V.S. Arunachalam in his address outlined the various important applications of luminescent materials. He referred to the new therapy called photo-dynamic therapy which uses luminescent materials. It was being tried by the Institute of Nuclear Medicine and Applied Sciences (INMAS), New Delhi. This therapy would enable the doctors to give the accurate amount of radiation required for a cancer patient. Pointing out that not much headway had been made in fluorescent lamp technology, he called for an active R&D work in this area with the aim to get more light with less power consumption.

The conference was held in ten scientific sessions devoted to specific topics. Prof. Won Choi (Korea) was the Chairman of the first session devoted to Luminescence Phenomena, where Prof. B. Ray (UK) presented his paper on II-VI sulphides, highlighting the recent developments related to these materials and their applications. Prof. Rashba (USSR) discussed the theory of self trapping rates.

In the second session on Luminescence Phenomena, Prof. Shigeo Shionoya (Japan) presented his paper on photo-stimulation of luminescence. He covered the recent technology of PSL, particularly in radiography imaging. Prof. C. Pedrini (France) presented his paper on Photoionization processes of Eu^{2+} in ionic crystals and their implications with regard to fluorescent properties. Prof. C.H. Kim (Korea) explained the Mn^{2+} luminescence in borate matrices.

In session III devoted to Materials Preparation and Characterization (Chairman: Prof. K.I. Vasu), Dr F. Auzel (France) highlighted the upconversion process, particularly ion-coupled ion systems. Dr G.E. Giakovmakis (Greece) presented his paper on Phosphor for X-ray screens. Photoluminescence of Tb activated Al_2O_3 films was discussed by Prof. Falcony (Mexico);.

The fourth session was devoted to Luminescence Phenomena (Chairman: Dr F. Auzel). In this session were covered: Radiationless processes in colour centres (Prof. G. Baldacchini, Italy), Dynamic disordered luminescence in solids (Prof. Tale, USSR), Spin selective process in phosphorescence of molecular crystals (Dr A.A. Avdeenko, USSR) and Pyroelectroluminescene (Dr K.S.V. Nambi, India).

Prof. P.F. Braunlich (USA) described recent advances in laser/electro-optic technology related to the design of desk top TLD reader and remote fibre-optic TLD sensor probe. Dr A.R. Lakshmanan (India) described the role of TL in radiation protection dosimetry and Dr F. Spurny (Czechoslovakia) described the role of TL in neutron and beta radiation dosimetry in the fifth session (Chairman: Dr Nagarathnam).

Dr V.S. Arunachalam, Scientific Adviser to the Defence Minister, delivering the inaugural address at the International Conference on Luminescence at CECRI, Karaikudi

In the next session devoted to Luminescence Phenomena, Prof. Boulan (France) presented his work on Optical properties of Cr^{3+} doped inorganic materials. Prof. B.P. Chandra (India) presented a paper on Recent trends in mechanoluminescence and Prof. V.P. Gribkovskii (USSR) discussed about Excitation luminescence by streamer discharges in semiconductors. Prof. Luo Xi (China) and Prof. S.V. Pakeva (Bulgaria) discussed EL of ZnS based phosphors. This session was chaired by Prof. G. Baldacchini.

The first session on the concluding day covered papers relating to Group II-VI compounds: Wide band gap semiconductors and devices (Dr R.N. Bhargava, USA); Laser stimulated luminescence and applications (Dr V.K. Mathur, USA), Optical and electronic properties of IIa-VIb materials (Prof. Koda, Japan) and Localized excitations in disordered mixed crystals (Dr F.A. Majumder, UK).

In the next session, also devoted to Group II-VI compounds, Prof. P. Benalloul (France) discussed recent trends in TFEL display devices, and Dr K. Chakrabarti (USA) presented a stimulating paper on optical sensors. Dr R.N. Bharagava was the chairman of this session.

The third session on the concluding day was on TL and TLD. Dr M.S. Jahan (USA) presented a paper dealing with luminescence in high temperature superconductors. Some of the interesting papers in this session were: TL of glasses by Dr Abbas (Egypt), TL mechanism by Dr J.K. Srivastava (India), TLD phosphors by Dr Mehrauli, Dynamics of metallic states by Prof. Pereire (Portugal), NaCl in TLD by Prof. Joshi, and Organic scientillators by Dr Rao and others.

Also, 46 papers were presented as posters covering various topics on luminescence. □

* * *

HEAT WHEEL — AN EFFICIENT AIR HEATER

NRDC Republic Day (1990) Award-winning Invention

Shri Mithiles Chakravarty, Scientist, Central Glass & Ceramic Research Institute, Calcutta, has been awarded a sum of Rs 25,000 for developing a heat wheel for recovering heat from hot flue gases. The system has a hybrid construction with fire clay bricks in the upper half and a metallic casing in the lower half. The packings are made of ceramic materials having high temperature stability and high thermal shock resistance. It has special flexible seals at the top and bottom of the basket to prevent inter-chamber leakage of hot air to flue gas. The heat wheel has a high thermal efficiency, low operating pressure differential, low maintenance and operational cost and low capital cost. □

National Seminar on Bio-Ceramics

The Central Glass & Ceramic Research Institute, Calcutta, organized a National Seminar on Bio-Ceramics, on 19 October 1989. Dr B.K. Sarkar, Director, CGCRI, inaugurated the seminar which was widely attended.

Dr A.K. Chandra, Director of the Institute of Post Graduate Medical Education and Research, SSKM Hospital and Dean, Faculty of Medicine, University of Calcutta, was the Chief Guest. In his address Dr Chandra dealt with the necessity of replacing damaged and broken parts of human body. He pointed out that bio-ceramics could go a long way to meet these needs and suggested inter-disciplinary approach for developing such materials.

The keynote address was delivered

Dr B.K. Sarkar, Director, CGCRI, Calcutta, delivering the inaugural address at the National Seminar on Bio-ceramics at CGCRI, Calcutta

by Prof. S. Basu of IIT, Bombay. He discussed various tests for the bio-compatibility evaluation of materials. In this context he presented the results of haemorheological tests obtained after keeping synthetic materials, including ceramics and glasses, in contact with blood, under standard conditions.

Invited papers presented in the seminar covered: (i) Sutures in surgery, (ii) Development of titanium and glassy carbon implants, (iii) Single tooth replacement with vitreous carbon implants, (iv) Acrylic aramid composites, (v) Tissue response of bioceramic materials, (vi) Ocular implant, (vii) Orthopaedic implants, (viii) Orthopaedic implants and bio-ceramics, (ix) Investigation on biocompatibility of sintered sillimanite, and (x) Glass and Glass-ceramics as bio-materials.

Following recommendations related to bio-ceramics were made in the panel discussion: (1) Initially, the studies should be confined to dental porcelain and oxide ceramics for prosthetic applications; (2) Studies should be made in close collaboration with R&D institutions, academic insitutes and industry; (3) Testing and evaluation may be carried out at IIT, Bombay; Indian Institute of Chemical Biology, Calcutta; Srichitra Medical Centre for Science and Technology, Trivandrum and National Chemical Laboratory, Pune; and (4) Implants should be developed as per specifications of ISI/International Standards Organisation. □

Brain Storming Session on Fuel Cells

A one-day brain storming session on Fuel Cells was held at the Central Electrochemical Research Institute (CECRI), Karaikudi, on 5 December 1989. Several research organizations, including BHEL, Hyderabad; TERI, New Delhi; NCML, Bombay; VSSC, Trivandrum and CECRI, participated in the session.

Explaining the objective of the session, Prof. S.K. Rangarajan, Director, CECRI, in his welcome address said that the session was planned with the help of CECRI Research Council to identify and focus on the priorities and to initiate interactions with other agencies interested in this field.

Dr R. Krishnan, Chief Coordinator, R&D, Defence, New Delhi, in his presidential address stressed the application of fuel cells in Defence, e.g. in submarines. He enumerated the various problems associated with fuel cell research.

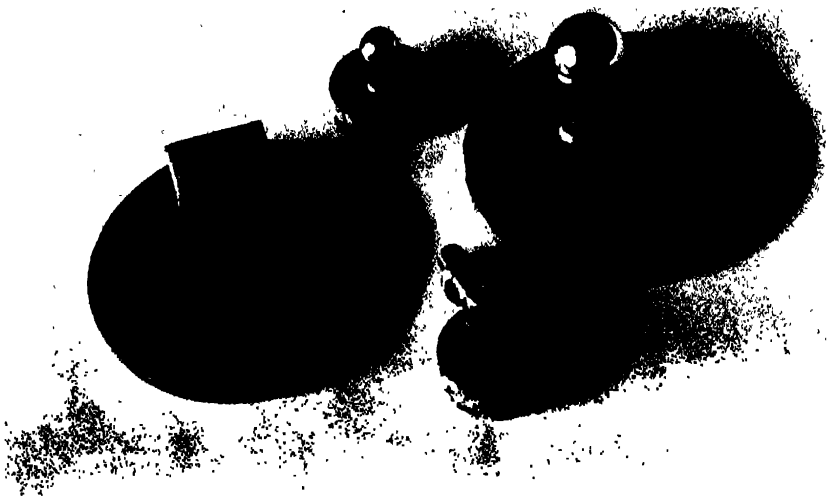
Dr J. Gururaja, Adviser, DNES, New Delhi, in his keynote address, outlined the efforts of DNES during the past few years towards evolving an All India Coordinated Project to develop the fuel cell technology.

The current technological status and development of various types of fuel cells, such as PAFC, MCFC, AFC and SOFC, were presented and discussed. In the panel discussion, the scientists deliberated on the identification of priority areas and problems to be sorted out in the development of these systems. It was decided that the work should be initiated on MCFC, SOFC and Solid Polymer Electrolyte Fuel Cells in addition to the development of PAFC. □

Prof. S.K. Rangarajan, Director, CECRI, Karaikudi, delivering the at the Brain Storming Session on Fuel Cells at CECRI, Karaikudi

Wear and Friction Studies on Advanced Ceramics at CGCRI

A facility for studying the thermo-mechanical properties and fracture of advanced ceramics was set up at the Central Glass & Ceramic Research Institute (CGCRI), Calcutta, in connection with an Aeronautical Research and Development Board (ARDB), project [*CSIR News*, 35(1985), 90]. The project was completed in 1987. Another project was assigned to CGCRI recently by ARDB, to study the wear and friction of advanced ceramics based on silicon nitride and composites, sialon, titanium nitride, silicon carbide and zirconia based products.



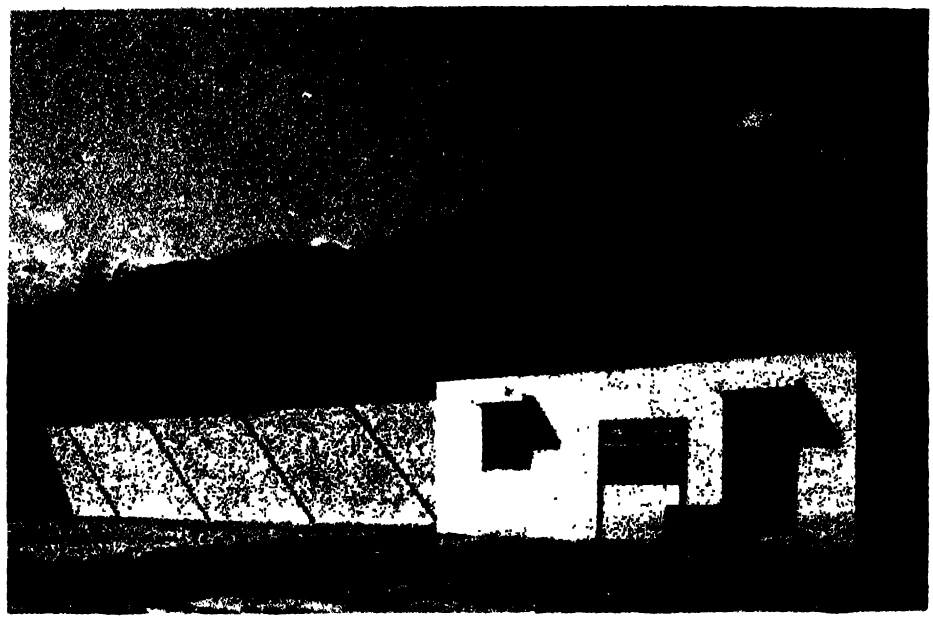
Sliding pair for friction and wear studies. Large discs on left and right are tetragonal zirconia under line contact and dense titanium nitride-alumina composite under Hartizan contact; Upper and lower small discs are sialon and dense silicon nitride

Wear and friction studies were carried out on sintered and hot press advanced ceramics under point loading and line contact as well as under condition of pin on disc where the pin was a diamond indenter. The tests were carried out under reciprocating sliding condition with and without lubrication. Studies under unidirectional sliding condition were also taken up. Initial studies up to 250°C showed promising results. The sliding pairs used were bearing steel ball against the ceramic, and diamond against the ceramic. Co-efficient of friction 0.45 (unlubricated) fell drastically below 0.1 with the addition of a drop of water as lubricant. Silicon nitride developed at CGCRI showed negligible wear at a load of 20 Newton, sliding velocity 0.1 m/s and total travel distance 900 m. Composites made from boron nitride and titanium carbide were found to be inferior to the best silicon nitride based ceramics. Zirconia based ceramics were inferior in their charcteristics as compared to the corresponding non-oxide ceramics. The specific wear rates of typical ceramics under above load and sliding conditions were found to be: silicon nitride—negligible, sialon (X = 0.5) — $1.5 \times 10^{-5} mm^3/m/N$, silicon nitride-boron nitride composites —$4.05 \times 10^{-5} mm^3/m/N$, silicon nitride-titanium carbide—$1.7 \times 10^{-5} mm^3/m/N$. The load test showed that nitride based ceramics would be excellent materials for bearing application at high load, high speed and high temperature. They can also withstand lubrication starvation. □

Lowcost Compost-making Unit for Button Mushroom

A lowcost compost-making unit has been designed, fabricated and installed at CSIR Complex, Palampur. The model unit is in production now and can provide quality compost material to local mushroom growers. The compost-making unit has a capacity of producing 60 tonnes compost per month which can meet the requirement of 18-20 small scale growers in the region. It is ideally suited for the hilly regions of the country where transportation costs are relatively high and carriage of compost material from one place to other is detrimental to the growth of mushroom industry. This type of composting units can be very useful for growing mushroom round the year.

The compost unit was inaugurated by Prof. N.K. Jain, Co-ordinating Director, in the presence of Dr R.M. Panday, Commissioner, Horticulture, Government of India and Dr Kirti Singh, Vice Chancellor, Himachal Pradesh Agricultural University, Palampur, on 27 November 1989. It has been built with totally indigenous material and is based on latest bulk



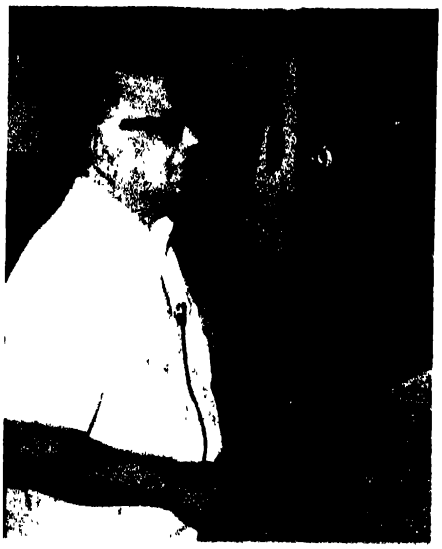
A view of lowcost compost-making unit for button mushroom at CSIR complex, Palampur

pasteurization technique. The unit has a low capital investment of around Rs 2.5 lakh only and can be installed by individuals or co-operative societies. □

Liposome Technology

Prof. B.K. Bachhawat's lecture at CDRI

Prof. B.K. Bachhawat, Head, Biochemistry Department, Delhi University, Delhi, delivered a lecture on Liposome Technology at the Central Drug Research Institute (CDRI),



Prof. B.K. Bachhawat delivering his lecture on Liposome Technology at CDRI, Lucknow

Lucknow, on 18 October 1989 under the CSIR Distinguished Lectures Scheme. Prof. K.P. Bhargava, former Principal of K.G.'s Medical College, Lucknow, presided over the function.

Prof. B.N. Dhawan, Director, CDRI, welcomed Prof. Bachhawat and the distinguished guests. Dr C.M. Gupta, Scientist, CDRI, introduced the speaker and highlighted his outstanding achievements.

Prof. Bachhawat in his thought provoking lecture highlighted the role of liposome technology in drug targeting, immunodiagnosis and vaccinology. He emphasized that liposome mediated drug targeting approach holds great promise in treatment of macrophage-based infections, like leishmaniasis, tuberculosis and leprosy. Also, he discussed the possibility of first delivering drug in liposomes to macrophages and then use of macrophages as drug depots for second level drug delivery. □

Statistical and Digital Signal Processing

Prof. Surendra Prasad's Bhatnagar Prize-winning Work*

Prof. Prasad's work over the last 15 years or so spans several facets of statistical and digital signal processing theories and applications on the one hand and design automation of digital systems on the other.

The earlier work of Prof. Prasad was in the area of communication receiver optimization for analog communication. In a large amount of work published by him on this subject, he proposed optimum, realizable receivers which, via the incorporation of a small fixed delay, could yield significant performance improvements. This work, in turn, has led to some fundamentally new insights of analog demodulation techniques for a large class of linear and nonlinear modulations.

His work in sensor array processing is addressed to a number of issues arising in the optimization of beam patterns, adaptive null steering and high resolution bearing estimation. The matrix theory base and geometrical approaches suggested by Prof. Prasad over the years have been demonstrated to yield simple, elegant and computationally efficient solutions to many arrary processing problems which may, otherwise, be quite interactable.

In the area of radar signal processing, Prof. Prasad has introduced two new concepts in the design of optimum MTI filters, viz. constrained optimization for effective simultaneous elimination of both stationary and moving clutter, and robust (min-max) optimization against a wide class of clutter spectra. Performance analyses of the two classes of filters have also been extensively documented. Two powerful digital architectures have been proposed and demonstrated for the real time implementation of these filters at a high throughput rate, as commonly encountered in radar systems.

One of the major thrusts of Prof. Prasad's work in recent years has been in the field of underwater electronics and sonar signal processing. He and his colleagues in the Signal Processing Group at IIT, Delhi, have executed a major research and manpower training programme in these areas. The systems developed under this programme include, among others, those for (acoustic) data communication in the oceans, omni directional sonar reception and high resolution sonars. Prof. Prasad and his team are currently deeply involved in fundamental research in the area of towed array signal processing.

Prof. Prasad and his students have innovated several techniques for the deconvolution of seismic signals in order to estimate the reflection from subsurface layer structures in geophysical exploration. This work attempts, for the first time, to effect deconvolution with high SNR enhancement and resolution on noisy and nonstationary

*Prof. Surendra Prasad of the Indian Institute of Technology, New Delhi, has been chosen for the 1988 Shanti Swarup Bhatnagar Prize in Engineering Sciences (along with Prof. B.D. Kulkarni of the National Chemical Laboratory Pune [*CSIR News*, 39 (1989), 251]

data commonly encountered in offshore explorations.

In digital communications, Prof. Prasad and his students have invented a new class of binary cipher sequences which combine the desirable features of a high linear complexity (to make evesdropping difficult) and the best possible autocorrelation function. An exciting new optimum class of sequence sets having both good auto- as well as cross-correlation functions has also been invented, which exhibits a high linear complexity.

Prof. Prasad and his students have recently made significant contributions in the field of VLSI design automation. An entirely new approach has been proposed for the realization of the control and data path structures of complex digital systems, which is at the same time more general as well as practical and represents a major advancement over the existing silicon compilers.

Prof. Prasad and his students have made a significant contribution in the field of adaptive filtering by proposing a fundamentally new representation of an ARMA process in terms of its projections onto some subspaces, and innovations. This work has led to the development of an entirely new and significantly improved least squares adaptive ARMA filtering algorithm which is of fundamental importance.

Prof. Prasad did his B.Tech(Hons) in Electronics and Communications from IIT-Kharagpur in 1969 and M.Tech and Ph.D. in Electrical Engineering from IIT-Delhi in 1971 and 1974, respectively. He has been teaching at IIT-Delhi since 1971, where he is currently a Professor of Electrical Engineering, leading the Telematics and Signal Processing Group of the institute. He was a visiting research fellow at the Loughborough University, UK, for a year in 1976 and a visiting Professor at the Pennsylvania State University, USA, during 1985-1986. He has delivered lectures at several universities abroad and has chaired technical sessions in several international conferences. He was the co-chairman of the technical programme and the organizing committee of the Indo-US Workshop on Spectral Analysis, held in New Delhi (27-29 Nov. 1989). Recently, Prof. Prasad has co-authored a book on Statistical Signal Processing (jointly with the late Professor A.K. Mahalanabis), which would be published in 1990 by Prentice Hall Inc., and has been the guest editor of a special issue of the Journal of IETE, on Statistical Signal Processing, brought out in 1989. □

Studies towards Understanding of Molecular Mechanism of Meiosis during Spermatogenesis

Prof. M.R.S. Rao's Bhatnagar Prizewinning Work*

The formation of spermatozoa and ovum is one of the most fascinating biological processes in mammals. Both during spermatogenesis and oogenesis, the diploid germ cells finally give rise to haploid gametes. In this process of meiotic division, exchange of genetic material takes place between the two parental homologous chromosomes giving rise to genetically diverse haploid gametes. One of the challenging problems in this area of research has been to understand the nature of chromosome pairing and genetic recombination.

Dr Rao's laboratory has been studying the chromosome structure of pachytene spermatocytes, a stage at which the pairing is completed and genetic recombination is achieved. The laboratory has shown that the testis-specific histones which are expressed only in germ cells do loosen the chromatin structure to facilitate the exchange of DNA strands between the paired chromosomes. Furthermore, it has also identified a germ cell specific protein which is a component of the synaptonemal complexes. This protein is shown to be antigenically conserved not only among mammals but also in amphibians, insects, avians and plant meiocytes.

Dr Rao's laboratory has also been studying the nature of chromosome condensation during spermiogenesis. One of the transition proteins, TPI, appearing very shortly in spermiogenesis is shown to be a DNA melting protein. This property has been implicated in the transformation of a nucleohistone complex into a nucleoprotamine fibre.

Prof. Rao (born 21 Jan. 1948) took his B.Sc. and M.Sc. degrees from the Bangalore University in 1966 and 1968, respectively, and Ph.D. degree from the Indian Institute of Science (IISc) in 1973.

He was Assistant Professor in the Baylor College of Medicine, Houston, Texas, from July 1976 to December 1977. Joining IISc in January 1978 as Senior Research Fellow, he became Assistant Professor in March 1982, and Associate Professor in March 1987.

He was Visiting Associate Professor at the Harvard Medical School,

*Prof. M.R.S Rao of the Department of Biochemistry, Indian Institute of Science, Bangalore, has been chosen for the 1988 Shanti Swarup Bhatnagar Prize in Biological Sciences (along with Dr B. Bhattacharyya of the Bose Institute, Calcutta) [*CSIR News*, 39(1989), 250]

Boston, during July-October 1988, and September-November 1989.

He is fellow of the Indian Academy of Sciences, and a recipient of INSA Research Fellowship, and P.S. Sarma Memorial Award of the Society of Biological Chemists (India).

He has 65 research papers to his credit. □

Mineralogical investigations on sediments of continental margins of India and Central Indian Basin and phosphorites of Error Seamount, Northwestern Arabian Sea

Shri V. Puranchandra Rao of the National Institute of Oceanography (NIO), Goa, carried out detailed studies on clay minerals of the shelf sediments of the east and west coast of India, which indicate that the clay mineral suite of the glacial rivers, the Ganges and Indus, consists of high illite and chlorite and is different from the clay mineral suite of the peninsular rivers, which consists of relatively high montmorillonite and kaolinite. Macrotides operating at the Gulf of Kutch act as barriers to the longshore sediment transport to the Indus derived sediments and deposit them in the shelf south of the Gulf of Kutch. Similarly, the Ganges derived sediments do not reach the shelf off the peninsular rivers. It is because the anti-clockwise gyral flows at the head of the Bay of Bengal direct the sediments to the deep Bay. The differences in the nature and crystallinity of montmorillonites and variations in the abundance of illite, kaolinite and chlorite in the shelf sediments are attributed to the differences in geology and climate in the source area. The Godavari and Krishna derived sediments are transported northward on the shelf by the northeast flowing currents during the southwest monsoon. Scatter plots of illite and montmorillonite with sand and clay content show that they vary significantly with increasing sand percentage and the clay content is less than 30% in a given sample. Clay minerals do not represent their sources but reflect their energy conditions of the environment. Clay mineralogy indicates that there is a terrigenous flux into the Central Indian Basin. Authigenic Fe-rich montmorillonite is present in the siliceous and pelagic sediments.

Holocene phosphorites of the western continental shelf of India indicate that the phosphate is in the form of grains which consist of fungi and bacteria. It also occurs as an adhered material to the filaments within the algal nodules. Phosphatized material is more characteristic towards silicastic detritus. All these suggest that phosphatization of algal nodules is a relict microbial process rather than the upwelling process.

Phosphorites on the Error Seamount occur as laminated crusts and massive slabs. Laminated crust phosphorites consist of alternate layers of pale and dark coloured phosphate laminae, microlaminations and vadose diagenetic cements. Massive slab phosphorites are fine-grained and consist of geothitic and non-geothitic zones. SEM studies show globose structures encrusted by phosphate filaments and cyanobacterial filaments enclosed by phosphatic sheaths. Low-magnesium calcite and carbonate fluorapatite are the major minerals. Elemental sulphur, pyrrhotite and chlorite are present in acid insoluble residue. The researcher suggested that the phosphorites on Error Seamount are formed by vadose diagenetic processes of algal limestones during tertiary with microbial processes apparently playing a significant role.

Shri Rao worked under the guidance of Prof. M. Subba Rao, Department of Geology, Andhra University and was awarded Ph.D. degree by the Andhra University for these studies. □

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PROGRESS REPORTS

CIMAP Annual Report : 1988-89

The Central Institute of Aromatic and Medicinal Plants (CIMAP), Lucknow, has brought out its annual report for 1988-89. The salient R&D achievements accomplished by the institute during the period are presented here:

CIMAP/Bio-13, a varjety of citronella Java developed through tissue culture during 1987-88, was released to growers for commercial cultivation. Being a high oil yielder and rich in citronellal and geraniol, the variety holds great promise for higher production of better quality citronella oil.

Selected somaclones of Japanese mint were at the advanced stage of testing at different locations under the improvement programme through plant tissue culture.

Different improved strains of *Hyoscyamus muticus* were developed through protocloning from an established inbred line. Detailed field evaluation in terms of morphological, agronomical and chemical characteristics were underway. In addition, chlorate-resistant mutants and single gene recessive lethal pigment mutation in *H. muticus* were obtained. These are valuable for application in cell fusion and molecular biology.

Under a project funded by the Department of Environment, Government of India, the Plant Tissue Culture Division transferred plants of *Rheum emodi* to the institute's farms in Kashmir and developed plantlets of *Nardostachys jatamansi* through somatic embryogenesis.

The Genetics & Plant Breeding Division developed geraniol-rich lemongrass variety designated as GRL-1 which could be a potent substitute for palmarosa, specially on poor soils and undulating land. The Division also developed a high yielding variety of *Mentha citrata*, named as *Kiran*. Besides having distinctly superior oil yield, the newly developed variety exhibited excellent regeneration capacity. It has great potential

for increasing bergamot mint oil production per unit area and time.

Studies in Agronomy Division indicated that mint growers could utilize the mentha spent as an excellent source of plant nutrient to supplement the inorganic fertilizer requirement. A mint-based efficient cropping system, developed by the institute, has resulted in higher land use efficiency and net income.

Studies on harvesting schedule on palmarosa for sub-tropical region of Lucknow revealed that in order to obtain maximum oil yield per hectare with superior quality of oil the first harvest should be taken at seed setting stage and subsequent harvests at anthesis stage of crop. Pre-sowing irrigation in palmarosa reduced weed competition in nursery by 80%.

The production of arteether, a lipophilic derivative of artemisinin, was extended and about 70 g of arteether synthesized was supplied to the Central Drug Research Institute, Lucknow, for its clinical trials. The arteether has since been cleared by the Drug Controller of India for clinical trials (phase-II and III studies). A new and stereo selective process for the synthesis of arteether was developed and a patent application for this was filed.

A process for regeneration of silica gel used in the isolation of artemisinin was developed which would reduce the cost of production of the drug considerably.

Preliminary biotransformation studies using a well defined cell free system from *Artemisia annua* leaves indicated the catalytic conversion of arteannuin-B into artemisinin. The conversion efficiency was influenced by micanazol, and α-ketoglutarate. The oil distilled from *A. annua* has also found a place in the Indian perfumery industry. The crop has thus opened new vistas for its use under rural development programme in the Kashmir Valley.

In large-scale trials conducted at Srinagar and Lucknow, an improved variety of *A. annua*, named as *Asha*, gave about 29 q/ha leaf dry matter, 0.110% artemisinin and 3.19 kg/ha artemisinin yield as compared with the original base population from Kew, England, which produced about 18 q/ha leaf dry matter containing 0.080% artemisinin and 1.44 kg/ha artemisinin yield. Under commercial cultivation it would be possible to produce the drug at a cheaper rate.

In a vigorous programme on screening *Eucalyptus* spp., 40 diverse species growing in Kumaon region were screened by CIMAP Regional Centre, Pantnagar, for essential oil and wood value and identification of species suitable for hill and *tarai* tracts for oil alone and for oil and timber both (dual purpose). *Eucalyptus robertsonii* adapted to Kumaon hills was found to contain 6-10% oil with 75% cineole, whereas *E. melanopholia* having 2.0% oil with 78% cineole was good for *tarai* region. Among dual purpose species, *E. viminalis* followed by *E. microcorys* and *E. tereticorins* × *E. camaldulensis* followed by *E. saligna* were considered to be suitable for hill and *tarai* regions, respectively.

The studies carried out in Medicinal Plant Chemistry Division showed that saponin fraction of one of the varieties of Indian pseudo-ginseng, *Panax pseudo-ginseng* subsp. *himalaicus* var. *angustifolius*, has a high order of antistress, antiinflammatory and immunostimulant properties which could be compared with Korean ginseng. Two saponins isolated from *Curculigo orchioides* have shown a good order of immunostimulant activity. A new lignan was isolated from *Phyllanthus niruri* which is a potent antihepatotoxic drug. Also, a new host-selective phytotoxin was isolated from the culture filtrate of *Drechslera maydis* causing leaf blight in *Costus speciosus*. *Hamelia patens* was found to be a new source of ephedrine.

Biosynthesis of compounds of nootkatane group in *Vetiveria zizanioides* using radioactive MVA was worked out.

New computer programme packages were developed and existing ones were updated for use of biometricians, agronomists and physiologists. Besides, the database on medicinal and aromatic plants was updated.

Eighty research papers were published. Six handouts in Hindi, one each on Japanese mint, citronella, palmarosa, lemongrass, vetiver, and improved field distillation unit were brought out for the benefit of farmers of the Hindi speaking belt of the country. Also, a book covering chemistry, pharmacology and utilization of major medicinal plants of India, was brought out. Another book, Dictionary of Indian Medicinal Plants, was in the press. The institute provided general technical consultancy/know-how to 11 parties and received Rs 2.115 lakh as fee. This includes consultancy for survey and preparation of feasibility report for setting up of 2-3 demonstration farms/centres for growing of suitable medicinal and aromatic plants in Madhya Pradesh and processing of aromatic plants for their oils. The institute provided free technical advice to more than 1000 farmers for cultivation of medicinal/aromatic plants and marketing thereof. Under consultancy programme of the institute, J&K State Government Agriculture Department covered about 7 ha of farmers' land with 11,600 Bulgarian rose plants. Another 60,000 rose cuttings and 10 kg clary sage seeds were provided to them for raising nursery. Consultancy was also provided on growing of lavender and pyrethrum on the farmers' land. This would go a long way in extension of these valuable crops in Kashmir Valley and providing ample job opportunities to the rural people. Approximately Rs 265 million worth of essential oils were produced as a result of transfer of technologies by the institute thereby saving foreign exchange to that extent, during the year.

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TRAINING COURSES

Second ESCAP Training Course on Optimal Standards for Design Construction and Maintenance of Rural Roads

The second ESCAP-sponsored training course on 'Optimal Standards for Design, Construction and Maintenance of Rural Roads in Arid and Semi-arid Tropics' was organized by the Central Road Research Institute (CRRI), New Delhi, during 6 November-5 December 1989, under the ESCAP project: The Development of Infrastructure for Rural Roads. Twenty participants from Afghanistan, China, Mangolia, Iran and Iraq participated in the training course which included planning, design, materials, construction, quality control, maintenance, organization and management aspects of rural roads. It also provided a forum for exchange of information, sharing of experience, technical co-operation among the participating countries and an exposure to the Indian engineers to the new techniques and methodologies developed by other countries.

The valedictory function was held on 5 December and was attended by the delegates, CRRI scientists and other invitees. Shri K.K. Sarin, Director General, Road Development, Ministry of Surface Transport, was the chief guest. Shri Sarin in his address, opined that the low volume roads for rural areas would have to be given priority and for each country an appropriate methodology would have to be evolved for their construction.

Shri T.K. Natarajan, in his introductory remarks, outlined the importance of the training course and gave details about the topics discussed.

Dr M.P. Dhir and Prof. S.R. Mehra, former Directors of CRRI, also addressed the gathering. Dr Dhir in his address said that till recently emphasis was given to the development of roads which carry large volumes of traffic, but now it was an accepted fact that the roads carrying low volume traffic need attention for the socio-economic development of the rural areas. Prof. Mehra stressed the need to use locally available soils and aggregates in road construction in view of the scarcity of hard aggregates.

Shri S. Rama Murthy from UNDP spoke about the large number of programmes in progress under the joint sponsorship of UNDP and ESCAP, and thanked CRRI for providing facilities for conducting the training programme. □

Electroplating Course at Malappuram under the Entrepreneur Development Programme

An Electroplating Course under the Entrepreneur Development Programme was organized by the Cochin Unit of the Central Electrochemical Research Institute (CECRI) in collaboration with the Kerala Financial Corporation, Trivandrum, at Malappuram, during 25-29 September 1989. The course was inaugurated by Dr S. Guruviah, Deputy Director, CECRI, Karaikudi, who in his address gave a detailed account of the research work carried out at CECRI in the field of electroplating. He said that the electroplating units in the country are using readymade baths owing to the lack of knowledge about the preparation of baths. He said that CECRI has developed processes for preparation of baths, brighteners, etc. The laboratory was making efforts to reduce the cost of plating. CECRI was willing to help the electroplating units to overcome their specific problems.

Shri K. Balakrishnan Nair, General Manager, Malappuram District Co-operative Bank, who presided over the function, spoke about the efforts made by CECRI and KFC to hold the Entrepreneur Development Programme in Malappuram district which is industrially backward. He said that there is no electroplating unit in Malappuram and hoped that this programme would help some entrepreneurs in setting up electroplating units in Malappuram. He assured his bank's cooperation in financing the interested entrepreneurs for establishing these units.

Shri P.L. Joseph, Scientist-in-Charge, in his welcome address mentioned about the efforts made by Shri Jawaharlal Nehru, Dr Alagappa Chettiar and Dr Bhatnagar in establishing the Electrochemical Research Laboratory at Karaikudi. CECRI had developed over 150 processes, and more than hundred of these processes had been commercialized. The present electroplating course would be beneficial to the would be entrepreneurs. The entrepreneurs were welcome to CECRI Cochin Unit for further discussions regarding project profiles and preparation of feasibility reports, Shri Joseph said.

Shri T.P. Madhavan, Course Co-ordinator and Scientist, CECRI Cochin Unit, proposed a vote of thanks. Sixty persons participated in the five-day course. □

DEPUTATION BRIEFS

Dr L.V. Venkataraman

Dr L.V. Venkaraman, Area Coordinator, Autotrophic Cell Culture Discipline, Central Food Technological Research Institute (CFTRI), Mysore, was deputed to attend the International Symposium on Application of Biotechnological Methods and Recent Accomplishments of Economical Value in Asia, held at Chaulalongkorn University, Bangkok, during 5-9 November 1989. He presented the following two invited papers at the symposium: 'Microalgae as a source of food, biochemicals, bioenergy and biofertilizer' and 'Recent developments in food biotechnology using plant tissue culture and genetic engineering methods — Their rele-

vance to Asia'. He also visited the Biotechnology Department of Kesatsart University, a number of orchid farms which have used tissue culture for effecting improvements in floriculture by tissue culture, and National Inland Fisheries Institute.

Earlier, Dr Venkataraman was deputed to attend the 'International Symposium: Leaf Pro' 89, held in Italy during 1-7 October 1989. The symposium was arranged by the International Society of Green Vegetation Research and was attended by some 250 delegates from 26 countries. It was held at three places, viz. Pisa, Perugia and Viterbo, sequentially. The aspects of leaf proteins discussed at the symposium include: selection and suitability of crops, products for human use, small scale and commercial operations of leaf protein, and safety and standards. Unconventional uses of green vegetation and algal technology were also discussed. Use of closed photobioreactor system for algal production was also presented.

Dr Venkataraman delivered an invited lecture on 'Challenges of commercialization of spirulina'. He also visited the LPC (leaf protein concentrate) pilot plant set up by the Universita Degli Studi and Instituto-Di-Industri Agrarie, located at Cassalina. □

Honours & Awards

UNESCO/ROSTSCA Award to Dr V. Purnachandra Rao

Dr V. Purnachandra Rao, Scientist, Geological Oceanography Division of the National Institute of Oceanography, Goa, received the UNESCO/ROSTSCA Young Scientist Award for the year 1989 in applied, geological and marine sciences. The award has been conferred on him for his significant contribution to the understanding of the genesis of marine phosphorites which occur on continental margins and oceanic seamounts.

Dr Rao obtained his M.Sc. (Marine Sciences, Marine Geology) from the Andhra University, Waltair in 1980 and joined NIO the same year. He studied marine minerals of the continental margins and deep sea

sediments, phosphorites and polymetallic nodules. He was deputed to Malta and Egypt in connection with the training of onboard instruments of ORV *Sagar Kanya*. He was a visiting scientist to the Florida State University, USA, from 5 June to 18 September 1987 and to the University of Rouen, France, from 13 to 18 September 1988. He presented two invited papers on phosphorites, at the international conference held at the Oxford University, UK, during 5-12 September 1988. He has published 16 research papers of which 11 are in the international journals. He was awarded Ph.D. by the Andhra University in 1989. Presently, he is working on quaternary black shales (organic carbon rich sediments) of the eastern continental margin of India.

Prof. B.N. Gupta

Prof. B.N. Gupta, Scientist-in-Charge, Epidemiology Division, Industrial Toxicology Research Centre (ITRC), Lucknow, has been conferred the Dr C.S. Thakar Oration Award (1989) of the Indian Medical Association. This award is given to an eminent doctor for making significant contributions in the field of medical sciences and research. Dr Gupta received the award at the hands of Shri Om Prakash Chautala, Chief Minister of Haryana, during the Annual Conference of the Indian Medical Association, held on 25-30 December 1989 at Yamunanagar. The award carries a cash prize, a scroll of honour and a citation. Dr Gupta delivered an oration on 'Environmental Pollution and The Role of Medical Profession'.

Dr K.P. Mohanakumar

Dr K.P. Mohanakumar, Scientist, Indian Institute of Chemical Biology, Calcutta, has been elected as a member of the International Brain Research Organization (IBRO). World Federation of Neuroscientists. □

PATENTS FILED

851/DEL/89: Rope truss system with mechanical tensioning device, N.M. Raju, B.N. Mishra, R. Sahu, V. Venkateswarlu and B. Singh—Central Mining Research Station, Dhanbad.

852/DEL/89: Pit prop, N.M. Raju, S.P Sinha, L.M. Prasad, B.N. Mishra, Dhanesh Sharma, R. Sahu and B. Singh—Central Mining Research Station, Dhanbad.

1031/DEL/89: A process for the synthesis of novel 2-(4-2-piperidino-alkoxy phenyl)-3-substituted phenyl-2*H*-1-benzopyrans, R.S. Kapil—Regional Research Laboratory, Jammu and S. Durani, J.D. Dhar and B.S. Setty—Central Drug Research Institute, Lucknow.

1032/DEL/89: A process for the synthesis of novel 2-(4-alkoxyphenyl)-3-substituted phenyl-7H/alkoxy/acyl-2*H*-1-benzopyrans, R.S. Kapil—Regional Research Laboratory, Jammu and S. Durani, J.D. Dhar and B.S. Setty—Central Drug Research Institute, Lucknow.

1033/DEL/89: A process for the synthesis of 2-(4-alkoxyphenyl)-3-

substituted phenyl-7-alkoxy/acyl-2*H*-1-benzopyrans, R.S. Kapil—Regional Research Laboratory, Jammu and S. Durani, J.D. Dhar and B.S. Setty—Central Drug Research Institute, Lucknow.

1043/DEL/89: A process for the preparation of 4-bromo or 4-iodo-2, 8-bis (trifluoromethyl) quinoline, Y.V.D. Nageswar, H.M. Meshram and P.B.R. Sattur—Indian Institute of Chemical Technology, Hyderabad

1044/DEL/89: An improved process for the preparation of α-2-pyridyl-2,8-bis (trifluoromethyl) quinoline, Y.V.D. Nageswar, H.M. Meshram and P.B.R. Sattur—Indian Institute of Chemical Technology, Hyderabad.

1045/DEL/89: An improved process for the preparation of mefloquine hydrochloride, Y.V.D. Nageswar, H.M. Meshram and P.B.R. Sattur—Indian Institute of Chemical Technology, Hyderabad.

1046/DEL/89: Electronic capacitive voltage regulator, C.S.P. Kumar, A. Kumar and K. Bangari—National Physical Laboratory, New Delhi.

1047/DEL/89: A process for the synthesis of alkyl 5(6)-[(N^1, N^3-dicarbalkoxyguanidino) phenyl] carbonylbenzimidazole-2-carbamates, V. Ojha, J. Singh, D.S. Bhakuni, Som Nath, A. Dutta and R.K. Chatterjee—Central Drug Research Institute, Lucknow.

1048/DEL/89: A method for the production of magnesia enriched dolomite sinters by single stage process of sintering, G. Banerjee, S.K. Das, A. Ghosh, P.K. Das and J.R. Biswas—Central Glass & Ceramic Research Institute, Calcutta.

1049/DEL/89: A method for the manufacture of oxide nitride and nitride carbide composite powders, J. Mukerji—Central Glass & Ceramic Research Institute, Calcutta.

1050/DEL/89: A process for the synthesis of new generation molecular sieve, silicoaluminophosphate, J. Das, A. Bhattacharya, S. Mitra and S.K. Roy—Central Fuel Research Institute, Dhanbad.

1051/DEL/89: A process for synthesis of metal aluminophosphate and metal silicoaluminophosphate, A. Bhattacharya, J. Das, S. Mitra and S.K. Roy—Central Fuel Research Institute, Dhanbad.

1096/DEL/89: A process for the preparation of novel sodium *p*-(12-α-dihydroartemisinioxy) methyl benzoate, useful as an antimalarial drug, R.A. Vishwakarma, R. Mehrotra and R.S. Thakur—Central Institute of Medicinal and Aromatic Plants, Lucknow.

1097/DEL/89: An improved process for the preparation of high purity super fine alpha alumina useful as precursor for advanced ceramics, S.R. Das and S K. Guha—Central Glass & Ceramic Research Institute, Calcutta.

1098/DEL/89: An improved process for making foam insulation refractories from alumina, kyanite, China clay, fireclay and other refractory materials, A.K. Bose and M.R. Rao—National Metallurgical Laboratory, Jamshedpur.

1099/DEL/89: A process for the preparation of 4-cyano-2, 8-bis-(trifluoromethyl) quinoline, Y.V.D. Nageswar, H.M. Meshram, A.R. Prasad, S.R. Hashim and P.B.R. Sattur—Indian Institute of Chemical Technology, Hyderabad.

1100/DEL/89: An improved process for the preparation of 2-pyridyl-2, 8-bis-(trifluoromethyl)-4-quinolyl ketone, Y.V.D. Nageswar, H.M. Meshram, A.R. Prasad, S.R. Hashim and P.B.R. Sattur—Indian Institute of Chemical Technology, Hyderabad.

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1102/DEL/89: An improved process for the preparation of mefloquine hydrochloride, Y.V.D. Nageswar, H.M. Meshram, A.R. Prasad, S.R. Hashim and P.B.R. Sattur—Indian Institute of Chemical Technology, Hyderabad.

Padma Bhushan to Dr L.K. Doraiswamy and Prof. B.K. Bachhawat

Dr L.K. Doraiswamy, former Director of the National Chemical Laboratory, Pune and Prof. B.K. Bachhawat, former Director, Indian Institute of Chemical Biology, Calcutta, have been chosen for the Presidential honour Padma Bhushan on the occasion of Republic Day 1990. □

ANNOUNCEMENTS

Hari Om Ashram Prerit Shri S.S. Bhatnagar Research Award for Solar Energy

The Director, Central Salt & Marine Chemicals Research Institute, Bhavnagar, invites applications/nominations from person(s) who have carried out original research work in the field of Solar Energy for consideration for the above award for 1989. The award is of Rs 8000 to be divided into two cash prizes of Rs 5000 (Ist prize) and Rs 3000 (IInd prize).

The award is open to an Indian citizen/team for his/her/their outstanding original research work carried out during five years immediately preceding the year of grant of award, i.e. the work done during the period 1984-1988 will only be considered.

The application in the prescribed proforma along with the relevant documentary evidence (in six copies each) may please be submitted to: The Director, CSMCRI, Gijubhai Badheka Marg, Bhavnagar 364002, before 31 March 1990 for consideration of the expert committee.

The rules and regulations governing the award and the prescribed application form can be had from: The Scientist, Planning Cell, CSMCRI, Bhavnagar 364002, by sending a self addressed stamped envelope of 26.5 × 11 cm. □

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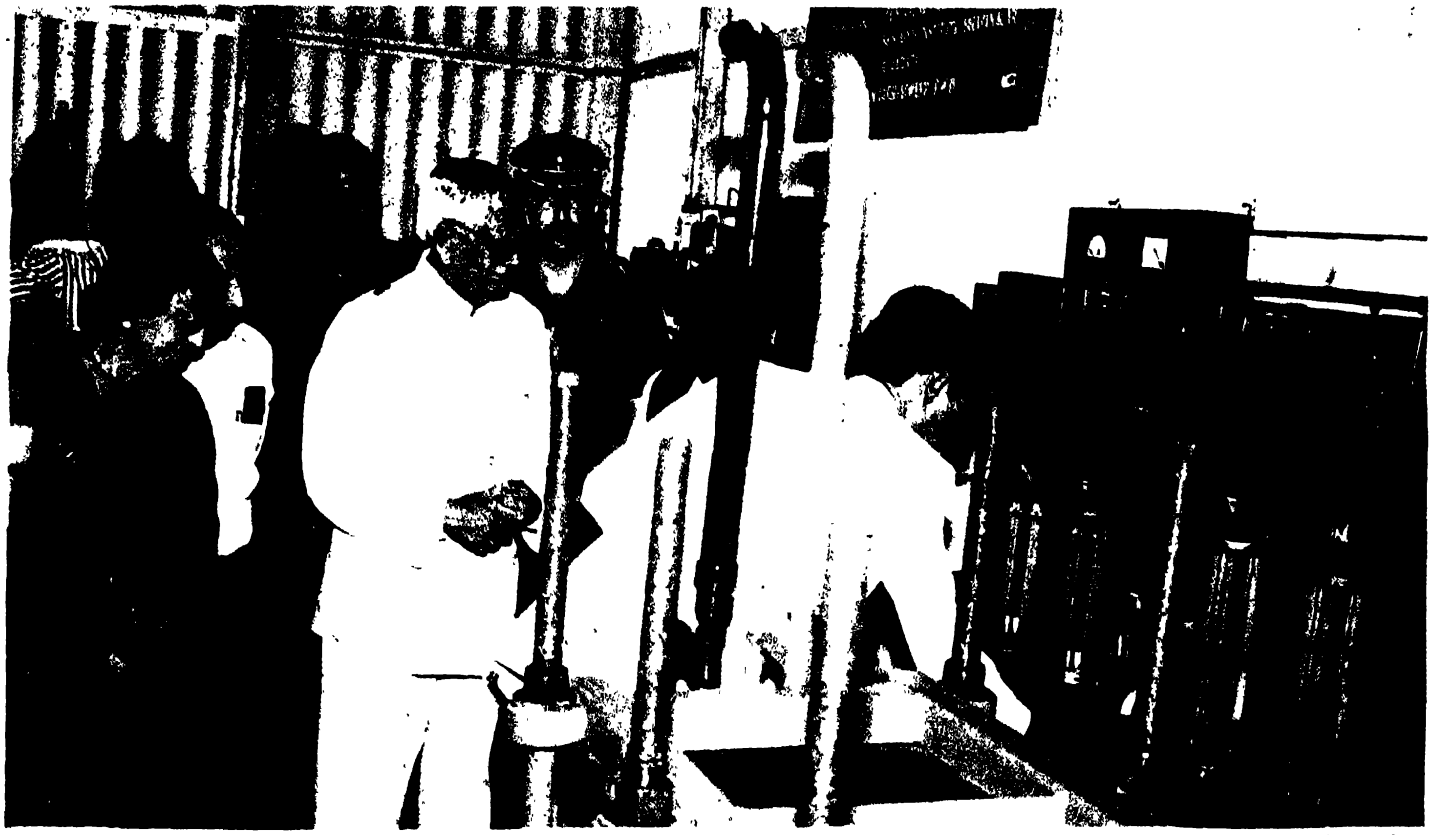

Shri R. Venkataraman, President of India, visited the electrodialysis desalination plant developed and installed by the Central Salt & Marine Chemicals Research Institute, Bhavnagar, at Kavaratti (Lakshadweep) island, on 28 December 1989. The plant, installed in early 1989, desalinates seawater in two stages and is the first of its kind in India. It caters to the need of potable water of 500 people. The Department of Rural Development of Government of India provided necessary funds for this plant. Another such plant will be installed by CSMCRI in Minicoy island, shortly.

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National Conference on Prospects for Transfer of Technology from Indigenous Sources to Indian Industry

A National Conference on Prospects for Transfer of Technology from Indigenous Sources to Indian Industry, organized jointly by CSIR and the Federation of Indian Chambers of Commerce & Industry (FICCI), was held in New Delhi on 10 January 1990. The conference was organized in two technical sessions and an open session besides the inaugural session. It was attended by about 200 participants representing a diverse cross-section of decision makers from the government, prominent industrialists and R&D chiefs of public and private sector units and scientists from R&D institutions.

In his welcome address, Shri Raunaq Singh, President, FICCI, said that over the years, research, both fundamental and applied, has been undertaken at the national laboratories. Yet a large gap subsists between technology generated and its utilization. This may be owing to the lack of sufficient interaction between national labs and industry. It was against this background that FICCI and CSIR set up a Consultative Group on Technology to help disseminate information about R&D in CSIR and other organizations, promote joint research and create a mechanism for assessment and acquisition of technology.

Under the aegis of this group, a series of meetings had been organized. CSIR laboratories were good enough to outline to industry areas of research undertaken by them for utilization thereof by private sector industry. Attempts have also been made to promote mutual exchange of scientific and technical personnel. This, we believe, would enable industrial units to project their specific technological problems as well as needs and seek assistance of CSIR scientists. The Group has identified four select areas which are on the frontiers of international research and in which industry will have to adopt latest technologies in the coming years. These areas are: engineering plastics, advanced materials, bio-technology and information technology. Project profiles are being prepared by experts to indicate global technological developments in these areas. The relevance of these developments to Indian industry is being identified. This would guide entrepreneurs in making investment decisions.

Stating that there could be several forms of interaction and cooperation between labs and industry, Shri Raunaq Singh suggested that industry, for instance, could entrust the research project to a particular lab or labs. Also, it could work in collaboration with the labs. Specific knowledge and scientific and technical personnel could be exchanged. A viable plan of coordination could be worked out at shop floor levels. Likewise, industry could indent for facilities including libraries and special equipment. After-all the work of the labs is directed at industry and industry, in turn, is constantly endeavouring to update and upgrade its technology. But we should be all clear in our minds that what we are looking forward to are result oriented technologies. Both, the R&D institutes and industry, would therefore stand to benefit by working hand in hand.

Shri Raunaq Singh further said that if we want to optimise utilization of our existing resources we must try not to duplicate efforts already made elsewhere; we can use our own resources more profitably. To begin with we must identify technologies of the future which we need to import and areas of their application. This effort can be made together by industry and CSIR. But the process should not stop there. It should lead to development of new processes and eventually to new, better products.

Labs should deploy resources to develop leading edge technologies, specifically tailored to suit industry's requirement. Also, aggressive marketing strategies directed at industrial customers are a must. In the kind of world we live in, time bound programme backed by efficient follow up

Seen on the dais at the National Conference on Prospects for Transfer of Technology from Indigenous Sources to Indian Industry (from left) are: Dr Ram K. Iyengar, Additional Director General, CSIR; Shri H.C. Gandhi, Secretary, Technology Development, Government of India; Shri Raunaq Singh, President, FICCI; and D.H. Pai Panandiker

is very essential. Transforming invention/innovation into commercial application is an expensive and a long route. Let us travel it together and to mutual advantage, Shri Raunaq Singh concluded.

Inaugurating the conference, Shri H.C. Gandhi, Secretary, Technical Development, Government of India, discussed the growth of R&D infrastructure in the country. Today, Shri Gandhi said, we have a broad spectrum of about 200 specialized research institutions covering scientific and industrial research, agriculture research, research in the area of space and in defence, nuclear, medical and other fields. Our achievements in the agriculture field, in the field of space and in nuclear sciences are well-known. Our science and technology manpower strength exceeds 25 lakh persons as against around 2 lakh at the time of Independence. There are more than 1000 R&D units in industry with an expenditure of around Rs 700 crores annually. While the above achievements are, no doubt, very creditable, much more needs to be done.

We are living in a world of fast changing technologies. A recent survey of 700 companies in USA indicated that new products with higher technological content accounted for 1/3rd of their profits in the decade of 80s as compared to 1/5th in the decade of 70s. The decade of 90s may perhaps take it to half. The Indian industry, therefore, today faces new challenges. Some of these are: (i) Product life cycles are getting shorter and shorter, (ii) Competitive market pressures are increasing, (iii) Explosion of information on the one hand is making users more demanding and on the other, increasing competition in terms of quality, price, performance, versatility and others, (iv) Product and services with new and advanced features are being introduced at a faster pace.

Therefore, there is a need for greater thrust on industry-oriented R&D and a close linkage between the two. Shri Gandhi suggested the following points in this direction:

(1) Industry should consider sponsoring more and more areas of research to R&D organizations.

(2) Particularly in the high tech areas, owing to expensive research involved, research on cooperative basis needs to be taken up.

(3) Aggressive marketing efforts should be made by the R&D organizations

(4) Greater in-house R&D efforts should be made by the industry towards technology generation, technology absorption and innovation. The amount spent by industry on R&D is meagre and compares very poorly with advanced countries.

(5) A certain portion of the activities of R&D establishments should be concentrated on 'technologies for industry'. It is not good enough to undertake research, it is equally important that it gets translated into successful manufacturing activity for the benefit of the user.

(6) While developing new technologies and upgrading the existing ones, one should be careful about the exploitation of resources, protection of environment and energy conservation.

(7) Most of the small scale units do not have in-house R&D facilities. Large industrial units and R&D establishments have, therefore, a special role to play in their technological upgradation and development of relevant technologies for that sector.

"Modern science and technology provides vast opportunities to the industry for growth and development and they must make full use of the existing potential", Shri Gandhi said.

Dr Ram K. Iyengar, Additional Director General, CSIR, and Co-Chairman of the FICCI-CSIR Consultative Group of Technology, delivered his address on 'Strategy for Cooperative Research by National Laboratories and User Industries for Accelerating National Development during the Eighth Plan'. In his address he stressed that development in the last decade of the twentieth century will have to rely as much on scientific information as on our ability to mobilize financial and other resources and our organizational and managerial capability to harness those resources. The rate of growth of scientific knowledge is at an exponential pace. New innovations in the products, processes, techniques and services are taking place at mind boggling pace. Behind all innovations is the practical use of scientific principles. The scientific workers of today not only have to make the innovation work, but also have to understand the scientific principles, laws and correlations which enable the innovations perform optimally.

In order to build a continuous and state-of-the-art database, it is essential that research programmes in national laboratories are based on nation's developmental needs. These programmes should preferably emanate from the users' requirements and should be interactive, multidisciplinary and capable of developing generic technologies. Research on drugs and pharmaceuticals, catalysts and on some materials in national laboratories fall in these categories. The research programmes on coal, steel, and road construction are also oriented towards generating scientific information to meet the requirements of the developmental programmes of the country. It is imperative that most of the research programmes in the national laboratories be user oriented.

In the Eighth Plan, it will have to be ensured that technologies of relevance are available to transform the industry from its present production orientation towards improved quality and international competitiveness. Whereas industry is the backbone for economic development, R&D is essential for maintaining an edge on quality, cost, new product development and to make Indian industry globally competitive.

Scientific knowledge alone cannot guarantee technological capabilities unless it is followed up by an extensive effort for its application. The exten-

sion of scientific research to assist industry would not be possible unless strong linkages are established between industry and national laboratories. Industry will also have to play a major role in identifying areas of research where national laboratories can concentrate. This can be done through the process of technology assessment and identifying technology that would become important or relevant in the future. R&D in industry should recognize the important contribution that Technology Information Forecasting and Assessment Council (TIFAC) can make in this regard and evolve a close collaborative system in which they participate in technology identification. During the Eighth Plan it would be necessary that R&D in industry cooperates with national research institutions to identify issues of relevance by linking R&D expenditure to benefits and markets. Status survey of technologies in Indian industry in comparison with the global state-of-the-art would identify the gaps in terms of technological parameters which would need to be attained for reaching higher levels of technological performance.

The industry must recognize the concept of 'technological convergence'. According to this concept several seemingly different industries converge upon the same tools, machines, equipment or unit operations. Because of these convergences, the improvements made in some common machines or unit operations can have an impact extending far beyond their individual industrial application. The introduction of relatively small number of innovative but similar productive processes to a large number of industries enables a greater growth of industry than an innovation in a highly specialized equipment. Cooperative research, especially in processes, equipment, machineries such as welding technology, machine tools, pressure vessels, process control instrumentation, etc. can give a quantum leap in the capability of the industry to modernize its existing facilities. The acid test for co-operative applied research would be that the cost of implementation, of new developments or systems should be paid back several times over, by the benefits that accrue.

Cooperative research programmes preferably in mission mode should be set up during the Eighth Plan. There would be a sea change in the product's specifications and greater demand for higher quality during the coming years. This would leave no alternative but to go in for the most modern equipment and manufacturing technology. More co-operative research associations need to be set up to develop capabilities in the latest technologies and their selective adaptation. The scientific workers will be required to have an indepth knowledge of the problems of the industry covering all sectors. The nature and quantum of technical inputs will have to be at advanced level to overcome the existing problems faced by the industry on the one hand and to strengthen the capability in those areas where Indian industry would have comparative global advantage, on the other. Such a strategy calls for not only a strong R&D base but also for enhanced capability of design engineering and manufacture of machineries and the capital goods.

Although indigenous R&D should be encouraged to accelerate technological development, industry would continue to rely on import of technology in the near future. It would be necessary to ensure that the technologies being imported are obtained after thorough preparation. For this purpose, R&D in industry and national laboratories will have to increase the technological capabilities to a higher level to understand the importance of modified product designs, improved production processes, and the requirement for higher performance standards. In this respect, the emergence of technology-based enterprises should be encouraged, which can support rapid absorption of technologies, their adoption to suit the requirements of the industry and ensure effective introduction of new or modified products in a national market while trying to capture share of the global market.

In order to ensure that the imported technologies are properly assimilated, adopted and further developed, the expenditure on R&D should increase at a much faster rate. It may be important to note that during its developmental phase, Japan spent almost ten times more on R&D expenditure as compared to expenditure on import of technology. During the Eighth Plan, the expenditure on R&D by government in the various national laboratories would continue to be much higher than the expenditure on R&D in the industry. The government has also recognized that identification of users at the commencement of any R&D programme ensures proper definition of the problems and better utilization of the R&D resources. Therefore, with its limited resources, R&D in industry can position itself in such a way that its expenditure can become catalytic and provide the multiplier effect to make the government R&D expenditure more user-oriented.

Although the organized industry has recognized the need for industrial R&D, a large number of small industries have made very little or no R&D effort worth mentioning. The reason for the lack of R&D in small industries may be traced to the apathetic attitude of the organized sector towards small industries. This needs to be corrected in the Eighth Plan. The industry will have to recognize that the technological innovations would be the major stimulant for growth. A new culture needs to be inculcated in the industry where the organizations would systematically support and encourage individual acts of creativity.

In order to make Indian industry internationally competitive, the co-operative research associations, in collaboration with national laboratories, will have to concentrate on

the development of technologies and processes in several thrust areas such as:

- Computer aided design
- Development of new products specifications and quality assurance programmes
- Development of special materials to meet the enhanced performance requirement of the product
- Development of a strong information/data base on international trends for a determined thrust on exports
- Application of advanced electronics including:

  Education and training of the user industry to enable appreciation of the changes in man-machine interface

  Monitoring control/Management system for improved production, higher quality and lower cost

  Development of cost effective electronic instruments, microprocessor-based instruments and necessary software to upgrade the existing processes and operating systems
- Diversification into new and different products

  Energy conservation and pollution control

  Energy conservation would require process optimization, energy conservation techniques and substitution of high level energy by alternative sources of energy
- Major thrust is needed towards innovative indigenous development of lowcost pollution monitoring and control devices
- Process control, process engineering, design and development.

Finally, the result-oriented applied research can benefit the user industry only through long-term basic research. The accelerated pace of progress in science and technology is such that developments which took a century to perfect in early years are being achieved today in less than a decade. Technological and engineering developments are dependent more and more on the advancement of science. A strong foundation in basic research is *sine qua non* for an understanding of technological developments and their evaluation. A strong collaboration between universities, national laboratories and co-operative research associations will stimulate basic research.

In conclusion, the industry will have to recognize that it will have to change its strategy of merely acquiring production capability and will have to give more emphasis on innovation to meet the emerging needs of the market. When an industry undertakes to import a technology, sometimes this transfer tends to bypass the process of national development. Very often the vast expertise available in national laboratories is not brought to bear in the planning, management and success of a project based on imported technology. The choice of technology and the manner of its exploitation are crucial issues which concern national development.

During the Eighth Plan, national laboratories along with R&D in industry will have to play a vital, intervening role to influence socio-economic development and the national objectives of self-reliance. To attain this, Dr Iyengar made the following suggestions:

(1) It is essential to make investment in R&D relevant to development of products and services required by the country. The research programmes in national laboratories should have financial and intellectual participation from the co-operative research associations of the users to lower the cost of goods and services to the consumer.

(2) More attention has to be paid to materials and process research, quality improvement and standardization.

(3) Any industry desirous of importing technologies should commit at least five times the amount spent on imported technology towards R&D expenditure. They should involve national laboratories, design engineering organizations and technology-based enterprises which may be specially set up for technology forecasting evaluation and absorption.

(4) The government should fund R&D projects prepared by R&D in industry through a special fund, after a review by planners, scientists, technologists etc. The management of these R&D projects can be done by joint teams from industry, national laboratories and academia. However, the overall responsibility for the success should be that of the industry.

(5) There should be institution of awards for scientists and technologists who produce technologies for products and services in industrial sector, even if they do not publish their results in research journals.

(6) National laboratories should be encouraged to provide to the industrial R&D, facilities such as computerized literature service, instrumental analysis, pilot plant facilities, technical advisory consultancy, and the use of sophisticated equipment available in the national laboratories.

(7) A strong collaboration between universities, national laboratories and co-operative research associations should be encouraged to stimulate excellence in basic research.

Presentations were made by Dr S. Banerjee, Director, National Metallurgical Laboratory, Jamshedpur; and Dr Krishan Lal, Dr S.P. Agarwal, Dr U.T. Bhalerao, senior scientists from National Physical Laboratory, New Delhi; Indian Institute of Petroleum, Dehra Dun and Indian Institute of Chemical Technology, Hyderabad, respectively.

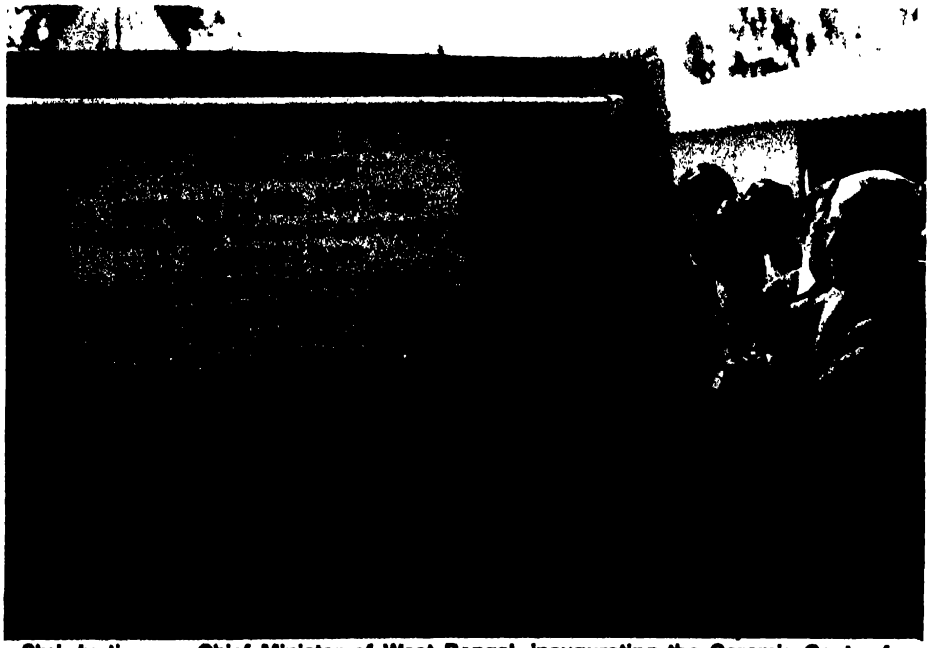
The second technical session was chaired by Shri Chandra Mohan, M.D., Punjab Tractors, Chandigarh. He suggested that in order to motivate CSIR scientists to carry out R&D work more enthusiastically they be given a share in royalty earnings. Shri N.K. Sharma, M.D., NRDC and Shri Vijay Dev Dabas, Manager (Market-

ing), C-Dot, in their presentations, highlighted their experiences in commercializing indigenous technology.

The concluding session was chaired by Shri Ashok Parthasarthy. Shri D.H. Pai Panandiker made an incisive analysis of the resources available to industry for R&D. He suggested a levy of 1% on the turnover or a surcharge of 5% on the excise duty as measures to generate resources for R&D by industry. Shri Parthasarthy welcomed these suggestions from the Secretary-General of FICCI and hoped that industry would seriously consider R&D as an investment which would more than pay for itself. He also urged FICCI to organize a special meeting where the captains of industry could participate to discuss and concretize these ideas further. □

Ceramic Centre for Rural Development at Panchmura, Bankura

Bankura District in West Bengal is inhabited by over 3000 potter households. These potters are well known for their excellence in the craft of pottery. However, the market for traditional products is fast shrinking owing to the availability of more durable and less expensive items made of aluminium, tin, etc. To alleviate the hardships faced by these potters because of the shrinking demand of their products, it is necessary to diversify their products and improve their quality so that these could find a steady market. With this end in view, a Techno-Economic Study was undertaken by the National Institute of Science, Technology and Development Studies (NISTADS) New Delhi, at Bankura, during 1982-83. On the basis of the findings of this study, the Central Glass & Ceramic Research Institute (CGCRI), Calcutta, undertook laboratory investigations to develop appropriate technology for the artisans of Bankura, keeping in view the skills of these potters and locally available raw material resources. CGCRI, Calcutta and its Khurja Centre in collaboration with NISTADS, developed a technology package for the manufacture of crockery, decorative items, rural sanitaryware, ceramic water filter candles, etc.



Shri Jyoti Chief Minister of West Bengal, inaugurating the Ceramic Centre for Rural Development at Panchmura, Bankura

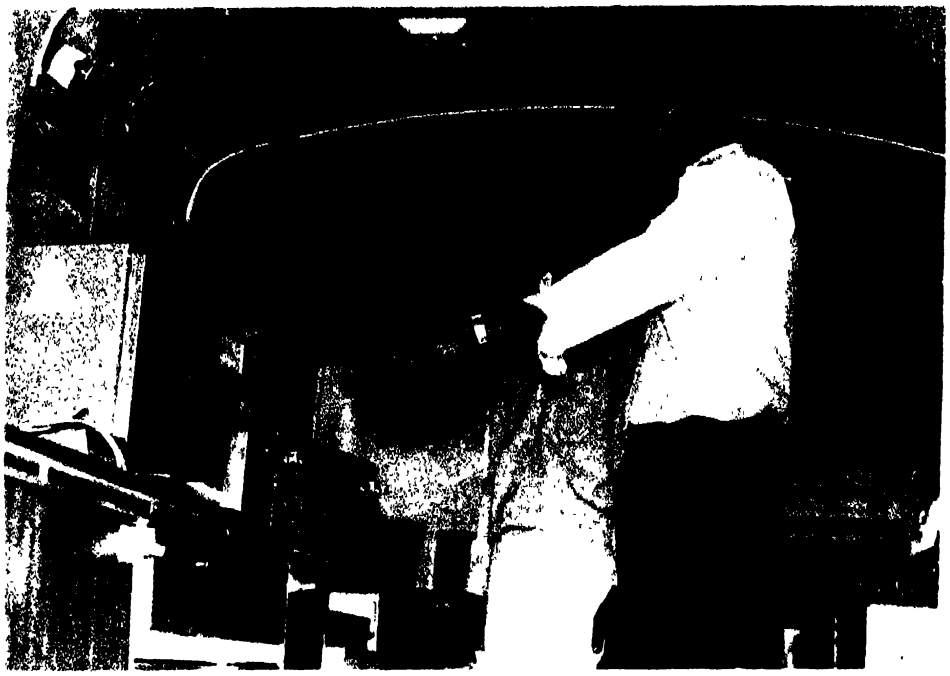
A programme was sponsored by CAPART, New Delhi, and C&SSI Department of West Bengal, for setting up a model Ceramic Centre at Panchmura village of West Bengal, for demonstration, training and production of lowcost ceramic items. The Centre has been set up over 10 acres of land which was handed over by the West Bengal Government to Zilla Parishad, Bankura, in December 1986. The objectives of the Centre are: (1) To impart training on the new technology package to potters of this area and also from other parts of the state, and (2) To serve as a Common Service Facility Centre (CSFC) to supply moulds, processed raw materials, glazes, etc. to the trained potters and entrepreneurs and provide facilities for firing their products in Low Thermal Mass (LTM) kilns.

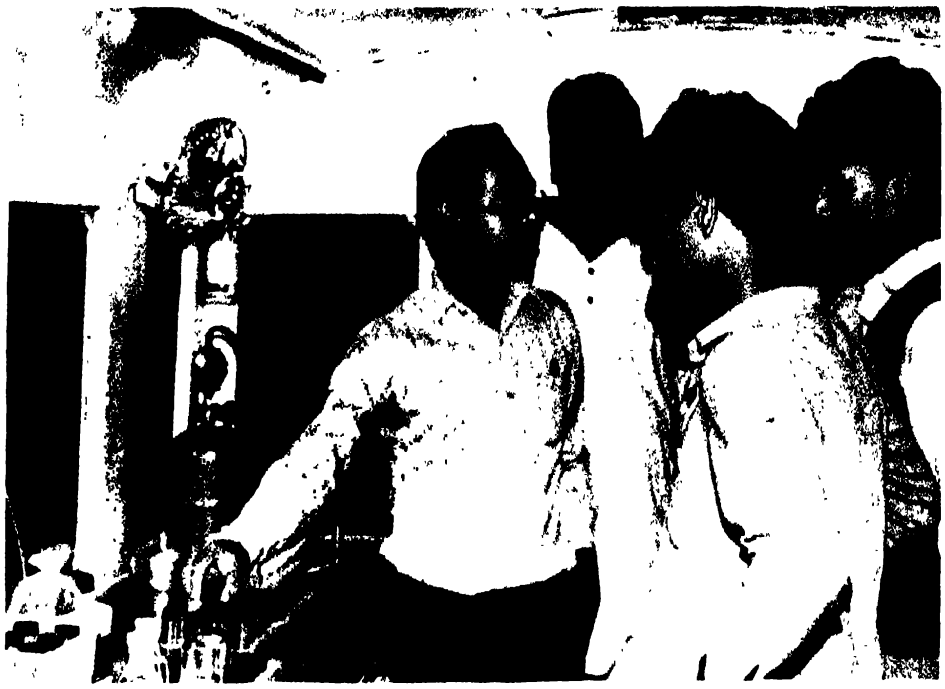
By utilizing the technology package of CGCRI it has been possible to produce lowcost water filter candles, sanitaryware, decorative items, etc. based on the locally available raw materials and agrowastes. An important element of the technology package is the LTM kiln which is 30 to 50% more fuel efficient than the conventional down draft kilns. With the help of LTM kiln, smoke pollution is also reduced substantially. Bricks made of rice husk ash, an agro-waste, have been used for insulation of the furnace installed at the worksite.

The necessary infrastructural facilities at the Centre have been set up by the Zilla Parishad and plants and equipment have been installed and commissioned by CGCRI. The technology has been standardized under the local conditions and trial productions made. The products of this centre have been found to be cost effective and of good quality. The Zilla Parishad, Bankura, took charge of the centre with effect from October 1988 and with the help of a few employees engaged on an ad-hoc basis and local artisans, it has started production.

Shri Jyoti Basu, Chief Minister of West Bengal, formally inaugurated the Centre on 31 December 1989. In his brief speech at the inaugural function, Shri Basu expressed satisfaction over the work done at Bankura by the CSIR laboratories and requested the scientists to come forward to update traditional technologies in the other areas of artisan and cottage industries of the state. He assured necessary financial and administrative support for transferring the laboratory developed technology to the field. On this occasion, Dr B.K. Sarkar, Director, CGCRI, handed over a report to the Chief Minister on the work done by CGCRI at Panchmura.

It is expected that when the centre is fully operational it will employ about 40 potters. Also, the local potters will be able to produce superior articles with the help of the equipment and facilities available at the centre. Success of the Bankura Project has attracted the attention of other states like Andhra Pradesh and Tamilnadu. North Eastern Council has also shown keen interest in the rural pottery industry. Recently, the Government of Madhya Pradesh has also approached the institute for exploring the feasibility of establishing such model centres in the district of Bastar. □





ITRC scientists explaining the working of water analysis kit (top), and bacteriological tests for assessment of drinking water quality, inside the mobile water testing laboratory

ITRC participates in Nehru Kisan Mela

The Water Mission Directorate, Ministry of Rural Development, participated in the Nehru Kisan Mela held in Allahabad during 11–19 November 1989. The Industrial Toxicology Research Centre (ITRC), Lucknow, being actively involved in the National Mission on Drinking Water, also participated and displayed exhibits on its activities related to the Mission, at the Directorate's pavillion 'Piyau Stambh'. The ITRC exhibits included: Portable Water Analysis Kit for on the spot analysis of essential physico-chemical parameters for drinking water quality assessment and the Mobile Water Testing Laboratory, for water quality assessment, and training. A lowcost and durable filtration equipment named as 'Amrit Kumbh', developed by ITRC for the removal of microorganisms and other pollutants, was also displayed.

[Please also see *CSIR News*, 40 (1990), 18 for CSIR participation in the Mela.]

Workshop-cum-school on Quality Assurance of Drugs and Pharmaceuticals

A workshop-cum-school on Quality Assurance of Drugs and Pharmaceuticals was organized jointly by the Indian Institute of Chemical Technology (IICT), Hyderabad and the Indian Society of Analytical Scientists

(ISAS), Hyderabad Chapter, at IICT during 31 October–4 November 1989. Sixteen scientists belonging to the various organizations participated in this course. Lectures were delivered by eminent scientists on almost all the latest techniques and methods which are generally employed for the quality assurance of drugs and pharmaceuticals. Dr A.V. Rama Rao, Director, IICT and President, ISAS, delivered a talk on : Indian Drug Industry — Its Retrospects and Prospects. □

Microbial Type Culture Collection and Gene Bank at IMTECH

The Microbial Type Culture Collection and Gene Bank (MTCC), a national facility, has been functioning at the Institute of Microbial Technology (IMTECH), Chandigarh, since 1987. Set up under the joint sponsorship of the Department of Biotechnology and CSIR, MTCC aims at providing services such as preservation, maintenance and supply of authentic microbial cultures to the scientific community. Researchers are encouraged to deposit cultures which are of industrial, genetic, taxonomic, biochemical, educational or of economic importance. After freeze drying the cultures received, MTCC supplies to the depositor, three ampoules of the culture received, free of cost. The depositor should open one of the ampoules, check that the culture represents the original strain and inform MTCC.

MTCC has brought out a catalogue of strains available at the Gene Bank. The catalogue is divided into four sections; Section A gives the alphabetic listing of strains under four subsections, namely, Actinomycetes, Bacteria, Fungi and Yeasts. Section B gives information about application, genetic stock and plasmids. Section C gives the composition of growth media recommended for each strain in Section A, and Section D gives numerical indexes of all the strains, irrespective of their taxonomic positions, held in MTCC.

The publication also describes the procedure of depositing the culture by a depositor and gives information regarding supply of cultures from the bank.

The catalogue (pp 120) can be had on request from: Curator, Microbial Type Culture Collection and Gene Bank (MTCC), IMTECH, P.O. Box. 1304, Sector-39A, Chandigarh 160036. □

Studies on energy and mass transfer during hydrothermal growth of quartz single crystals

Shri N. Annamalai, Scientist, Central Glass & Ceramic Research Institute (CGCRI), Calcutta, carried out studies on energy and mass transfer during hydrothermal growth of quartz single crystals.

Large single crystals of quartz needed for electronic industries are grown in batches by hydrothermal technique—a process in which an aqueous solution is held at high temperature and pressure to dissolve a material, which is transported to another part for its deposition on a seed crystal. The process is carried out in a high pressure sealed vertical autoclave with a temperature difference between the top and bottom portions of the vessel. The growth of the crystal is determined not only by molecular-kinetic and physico-chemical phenomena at the crystal solution interface, but also by processes taking place concurrently in the external medium, viz. the dissolution of the substance in the nutrient zone and its transfer to the growth zone. The latter processes determine the mass transfer and have an active influence on the temperature gradient inside the vessel. The dependence of mass transfer, and hence the growth rate of quartz crystal on the following parameters is well established: growth temperature, temperature difference, per cent fill of the internal chamber of the autoclave, concentration and nature of solvent, per cent opening in the baffle separating the nutrient zone from the growth zone, orientation and nature of the quartz single crystal seeds, and cumulative surface area of nutrient.

Shri Annamalai studied the nature of fluid flow and the combined effect of four important operating variables, namely, growth temperature (T), temperature difference (ΔT), pressure (P) and duration (time, t) on mass transfer for the growth of quartz single crystals. He analyzed the variation in mass transfer rate and thereby the growth rate of crystals and their quality as a function of depth in the growth zone. Mathematical correlations were generated which predict: (i) the rate of heat transfer as a function of modified Rayleigh number and (ii) the size of the crystal as function of T, ΔT, P and t.

A special type of thermocouple probe system which can withstand pressure of the order of 410 bar and temperatures up to 400°C was designed and fabricated and used for temperature measurements along the wall and the centre line of the autoclave, for heat transfer studies. A convection baffle to guide the fluid paths and to make convection the dominant mechanism, was also designed, fabricated and used for the crystal growth runs. The growth rate of the crystals using this convection baffle was found to decrease in a parabolic manner along the length of the growth zone as compared to linear decrease in the case of conventional flat baffle, i.e. lesser variation in crystal sizes of the same batch up to 50% depth of the growth zone. The convection baffle has another advantage—it yields flawless crystals in spite of power interruptions of longer duration during the growth experiments. Crystal quality values (mechanical Q) were measured by IR technique, and a correlation was obtained between these values and the corresponding positions along the growth zone.

A set of six runs was made to study the variation of mass transfer (growth rate) with time. These runs were interrupted by shutting off the power a number of times during the

growth. These interruptions caused very sharp interfaces to occur, usually visible to the eye in polished samples. By measuring the distance between interfaces the rate of decrease of growth was found to be exponential and correlated in the form $S_z = A_z - B_z \exp(C_z t)$ where 'S_z' is the size of crystal along z-axis and 't' is the time in number of days. 'A'_z', 'B'_z' and 'C'_z' are correlation coefficients which are empirically correlated to functions of T, ΔT, and P. Similar correlations for A_{+x}, C_{+x} and A_{-x}, C_{-x} were also generated.

The different faces of quartz crystals grow at different rates, thereby indicating that the rate-controlling step lies in the immediate vicinity of the growing crystal. This was qualitatively explained on the basis of Hartman-Perdock theory of Periodic Bond Chains (PBC).

The work carried out by the researcher will be useful as follows:

(i) The variation in growth rate along the depth of the autoclave can be reduced using the 'convection' baffle designed based on the study of fluid in the autoclave

(ii) The crystal growth system can be programmed or manually controlled to get a uniform growth and hence uniform quality throughout the cross section of the crystal, since the combined effect of each parameter and their reflection on growth rate is known.

(iii) Uniform quality throughout the cross section of the crystal can be achieved since the quality versus growth rate relation has been established.

(iv) The crystal size at any face can be calculated and growth cycle continued till that day when it has grown to the required size.

Shri Annamalai worked under the guidance of Prof. S.K. Ghosal, Professor of Chemical Engineering, Jadavpur University and Dr P. Saha, Deputy Director, CGCRI and was awarded Ph.D. (Engineering) degree by the Jadavpur University for his thesis based on the above studies. □

Marine geophysical investigations off Konkan coast

Shri M.V. Ramana of the National Institute of Oceanography (NIO), Goa, studied some geophysical anomalies in placer deposits, basement configuration and nature of the basement in Jaigad, Ambwah and Varvada bays situated along the Konkan coast. The geophysical studies comprised echosounding, shallow seismics and magnetics. The analysis of the data revealed lateral as well as depth-wise extension of heavy mineral placer sand (ilmenite and magnetite) up to the water depths of 9-11 m; beyond these depths, these sand bodies are covered by thin clay. The shallow seismic records show two or three prominent reflectors, the bottom-most reflector has been identified as the weathered derivation of Deccan Traps. The layers above this basement are enriched with different concentrations of heavy minerals.

An isonanotesla map was prepared on the basis of the magnetic investigations. The magnetic map is characterized by N-S, NW-SE, WNW-ESE and NNE-SSW trends. A reasonably good correlation was obtained between magnetic lineament trends identified in the offshore area and the structural trends established onshore. The following three different types of magnetic anomalies were conspicuous: (i) short wavelength low amplitude anomalies caused by different geometries of placer bodies, (ii) short wavelength and large amplitude magnetic anomalies caused by intrusives/dikes and (iii) large amplitude and medium to large wavelength anomalies, attributed to the basement dislocations. A significant feature of the anomaly map is an exclusive zone of positive anomalies in the southern part of the area. A first order correlation was established between the distribution of magnetite and magnetic anomalies. Two dimensional model studies of the area investigated indicated the presence of several intrusive bodies, dislocations, block movements and narrow shear zone. A structural element map and a basement map of the area were prepared, which depict the nature of the basement configuration.

Shri Ramana was awarded Ph.D. degree by the Andhra University, Waltair. He worked under the guidance of Prof. T.K.S. Prakasa Rao, Head, Department of Geophysics, Andhra University. □

Studies on Anaerobic Fixed Film Moving Bed Reactor for Treatment of Domestic Sewage

Shri V.P. Deshpande, while working at the National Environmental Engineering Research Institute (NEERI), Nagpur, studied the applicability of a novel and innovative reactor system incorporating attached anaerobic biomass for the treatment of low strength organic wastewater such as domestic sewage, and to develop various process kinetics for the microorganisms and biomass.

Anaerobic moving bed reactor system was found to be best suited for the treatment of low strength wastewaters because: (i) it is capable of treating organic wastewaters, (ii) it involves horizontal flow which reduces power requirements and (iii) it possesses high potential for energy recovery through product gas utilization. In addition, it enjoys all the advantages of fixed film concept, viz. attached microorganisms growth with high biomass retention capabilities resulting in short hydraulic detention times as compared to suspended growth systems.

Shri Deshpande conducted detailed studies on a 0.20 m^3 anaerobic moving bed reactor which was driven by variable speed motor. Domestic sewage from nearby residential colony was used in the experiments as substrate. A new and cheaper nylon pad medium was used for the bacterial growth support and was placed inside the rotating cage.

Tracer studies employing impulse dose technique and step decrease dose

technique with Rhodamine-B (tracer) indicated that the anaerobic moving bed system is quite close to 'complete mix' system. This observation is in close agreement with the findings of other researchers. The results of growth and kinetic study indicated that the reactor system, can be characterized by well-mixed models for CSTR system. These models were used to evaluate kinetic parameters such as organism decay rate (K_d) yield coefficient (Y) and half saturation constant(K_s). The results of CSTR models indicated that the microorganisms were in good state of microbial activity since the values of specific growth rate (μm) and K_d were presumably higher than those for conventional anaerobic reactors.

Various controlling parameters were studied in detail. Experiments conducted with different rotational speeds (rpm) indicated that the rotational speed affects the performance of anaerobic moving bed reactor up to a limiting rotational speed and at higher speeds the substrate removal efficiency increases marginally. The efficiency of waste stabilization was found to be directly proportional to the specific surface area and type of the support media. The optimum hydraulic retention time of the reactor was found to be 12 h which is much less compared to the anaerobic digesters. Below this HRT, the substrate removal efficiency decreased rapidly. Under increased loading conditions, it was found that the reactor could be loaded up to a maximum loading rate of 8 kg COD/m^3/day and the maximum removal efficiency achievable was in the range of 73-88%.

Various models employed to correlate biogas yield with loading rates revealed maximum specific methane production of 0.002 m^4 GH_4/m^{2}d which was independent of *p*H and temperature of the system.

For a cage diameter of 0.20 m and optimal rotational speed of 10 rpm, the net power consumption was found to be 34.72 W/m^3.

The studies on sludges obtained from the system showed good dewaterability characteristics and fertilizer values. Empirical formulae evolved for the sludge indicated high percentage of oxygen atoms and the sludge was well mineralized, digested with low volatile organic content.

The results of the investigation suggest that domestic sewage containing low strength organic material can be effectively treated by anaerobic moving bed reactor under optimum operational conditions, i.e. HRT = 0.5 day; temperature = 35°C; *p*H = 7; rpm = 10; specific area = 920.88 m^2/m^3 and loading rate 0.80–2.75 kg COD/m^{3}d.

Shri Deshpande worked under the guidance of Dr S.N. Kaul, Head, Wastewater Engineering Division of NEERI, and was awarded Ph.D. degree by the Nagpur University for his thesis based on these studies. □

Aero-magnetic Studies over Western Part of Cuddapah Basin and Adjoining Crystallines

Shri V. Babu Rao, Scientist, National Geophysical Research Institute, Hyderabad, carried out the aeromagnetic studies over the western part of the Cuddapah basin and the adjoining Archaean terrain. The study was aimed at bringing out the structural control in the initiation and development of the Proterozoic Cuddapah basin.

Within the Cuddapah basin, the western part is unique in many ways. It exposes the oldest as well as youngest sediments. There is preponderance of igneous activity in the form of basic sills and flows in this part. There are innumerable basic dykes and dyke swarms. It is believed that the igneous activity within and outside the basin is interrelated and holds the key to unravel the events that led to the initiation of the Cuddapah basin. The aeromagnetic coverage over the Archaean basement west of the basin provides an excellent opportunity to study the basement structures both within and outside the basin and to understand the role of tectonomagmatic episodes in the evolution of interacratonic sedimentary basins.

One of the significant results of the study is the recognition that the very long linear magnetic anomalies running into several tens of kilometres observed over the crystalline basement are essentially the fault and fracture lineaments. The intersecting magnetic lineaments do form rhombus and parallelograms which are considered as the reflection of the east-west compression experienced by the Archaean crust. Magnetic interpretation brought out the fracture pattern of the basement beneath the Cuddapah basin. Integrating the available geological and geophysical data with the results of magnetic interpretation, a combination of thermal trigger and reactivation of basement faults has been proposed to be responsible for the initiation of the proto-Cuddapah basin. The NNW-SSE to NW-SE and ENE-WSW trending basement fractures have played a critical role in aiding the formation and development of the basin structure on this part of the crust. The rejuvenation of and vertical tectonics along some fundamental fault fractures has led to the progressive development of different sub-basins of the Proterozoic Cuddapah basin.

A thesis based on these studies was adjudicated by Prof. G.D. Garland of the University of Toronto, Canada, Prof. R.K. Verma of Indian School of Mines, Dhanbad, and Prof. C. Naganna of the Bangalore University, Bangalore, and Shri Rao was awarded Ph.D. degree by the Andhra University. □

Salt balance and mixing in Bay of Bengal

Shri M.J. Varkey of the National Institute of Oceanography (NIO), Goa, studied the problems related to river run off, surface evaporation,

precipitation, horizontal and vertical water transports and turbulent mixing in the Bay of Bengal using the data and information available from different sources. The significant results of the study: (i) Information on seasonal precipitation was generated for the complete bay; (ii) Net surface exchange volumes (evaporation + precipitation + run off) for different 5° squares were worked out and mean values for north east monsoon (−11.5 cm) and south west monsoon (+63.7 cm) were computed; (iii) Mean seasonal surface current patterns were proposed; (iv) The penetration and seasonal variations of the high salinity water cores into the Bay of Bengal were brought out; (v) A new method was found for determining a reliable reference depth for geostrophic computations; (vi) Estimates of water transports across 6°N, both outwards and into, were worked out for the first time for north east monsoon, south west monsoon and for an average year; (vii) Water structure in the bay was studied in three domains, viz. deep bay, tropospheric bay and seasonal thermocline, and estimates of vertical velocities and eddy coefficients were worked out; and (viii) The different mixing patterns in different zones of Bay of Bengal were delineated and were classed into two characteristic T-S patterns, one for the outer bay (around 6°N) and the other for the inner bay.

Shri Varkey worked under the guidance of Dr J.S. Sastry, Deputy Director, NIO and was awarded Ph.D. degree by the Kerala University, Trivandrum. □

Dr A.N. Bhaduri appointed Director of IICB, Calcutta

Dr A.N. Bhaduri, Scientist in Director's Grade, Indian Institute of Chemical Biology (IICB), Calcutta, has taken over charge as Director of IICB with effect from 1 February, 1990. Dr S.C. Pakrashi retired as Director of the institute with effect from 31 January 1990.

Dr Bhaduri (born 11 Nov. 1935) took his B.Sc.(Hons) degree in Chemistry from the Calcutta University in 1955, M.Sc.(Tech) degree in Applied Chemistry from the Calcutta University in 1958 and D.Sc. degree

in Biochemistry from the University of Michigan in 1963. He worked as a Research Fellow at the Harvard Medical School from 1963 to 1965, before joining the Department of Pharmacy of the Jadavpur University in 1966 where he became Professor in 1976. He was appointed Scientist in Director's Grade at IICB, with effect from 15 January 1986.

Dr Bhaduri has made significant contributions in enzymology. Taking UDP glucose-4-epimerase as a model oxido-reductase, he has intensively studied the molecular mechanisms of catalysis and regulation for this enzyme. He is at present actively engaged in the field of parasite biochemistry.

Dr Bhaduri was a Visiting Scientist of the Roche Institute of Molecular Biology during 1975-76. He was Vice-President, Society of Biological Chemists (India) from 1984 to 1988. He is a Fellow of the Indian National Science Academy and the Indian Academy of Science; Member, Research Councils of several national research institutes; Member, Biochemistry Research Funding Committee of CSIR; Member, Biochemistry and Biophysics Funding Committee, Department of Science & Technology; Member Committee on Emeritus Scientists, CSIR; UGC-CSIR Committee for Junior Research Fellowships in Life Sciences; Member, International Union of Biochemistry (IUB) Committee, INSA and Scientific Coordinator of the UNDP-supported ($ 1.045 million) project (1988-93) on 'Molecular Biology and Biotechnology Applied to the Study of Parasites'. Also, he is on the editorial boards of *Journal of Biosciences* and *Indian Journal of Biochemistry and Biophysics*. He is recipient of the Bhatnagar prize (1979) in the field of Biological Sciences.

Dr Bhaduri has visited a number of scientific and research institutions in USA, Sweden, Canada and Australia. He has 35 publications to his credit. □

CONFERENCE BRIEFS

Tenth Australasian Fluid Mechanics Conference

Shri V. Krishnan, Scientist, National Aeronautical Laboratory (NAL), Bangalore, attended the Tenth Australasian Fluid Mechanics Conference (10 AFMC) held at the University of Melbourne, Australia, during 10-15 December 1989. AFMC is a triennial event held in Australia, with the objective of exchanging views and ideas in various areas of fluid mechanics. The conference was attended by about 230 scientists from various countries. About two-thirds of the participants were from Australia. In the conference about 170 papers were presented in four parallel sessions. Ten keynote papers by well known Fluid Dynamicists were a major attraction. The conference covered wide range of topics in experimental and theoretical fluid mechanics. Shri Krishnan presented a paper entitled: Observations on Turbulent Boundary Layer and the Near Wake of an Afterbody (V. Krishnan and K.S. Yajnik).

The University of Tasmania in Hobart was fixed as a venue for the Eleventh Australasian Fluid

Mechanics Conference to be held in 1992.

During his stay in Australia, Shri Krishnan also visited the experimental facilities in the University of Melbourne.

ANNOUNCEMENTS

International Symposium on Optical and Radio Remote Sensing of the Atmospheric Environment

The title symposium will be held at the National Physical Laboratory, New Delhi, during 24-26 October 1990, as a part of the Prof. S.K. Mitra's Birth Centenary celebrations in India. Prof. Mitra made pioneering contributions in the areas of Upper Atmospheric Physics and Radio Science, which have been internationally acclaimed. The symposium is being organized by a Committee, chaired by Dr A.P. Mitra, former President, URSI, and Director General, CSIR and constituted under the auspices of the Indian National Science Academy, New Delhi.

The scientific programme of the symposium will cover the following topics: Radars for Atmospheric Sciences; Neutral—Ionospheric Modelling; Lidar and Sodar Probing of the Atmosphere; Communication during Disturbances; Equatorial Ionosphere; Planetary Atmosphere—Neutral and Ionized; Magnetosphere; Solar Eclipses; Solar Radiations & Their Interactions with Terrestrial Atmosphere; Solar Terrestrial Relationship; Ozone Studies; Atmospheric Chemistry; Satellites and Atmosphere ; Radio, Infrared and Optical Remote Sensing; Solar Radio Astronomy and Radio Noise and EMI/EMC.

Further information can be had from: Dr B.S. Mathur, Convener, International Symposium Organizing Committee; and Science Secretary to DG, CSIR, Anusandhan Bhavan, Rafi Marg, New Delhi 110001. □

PATENTS FILED

1103/DEL/89: An improved process for the preparation of mefloquine hydrochloride, Y.V.D. Nageswar, H.M. Meshram, A.R. Prasad, S.R. Hashim and P.B.R. Sattur—Indian Institute of Chemical Technology, Hyderabad.

1104/DEL/89: A process for the preparation of water dispersable acrylic copolymer for use as a retanning agent, Y. Lakshminarayana, K.S.V. Srinivasan, N. Radhakrishnan, T. Ramasami, S. Ramalingam, K. Parthasarathi, K.S. Jayaraman and K.T. Joseph—Central Leather Research Institute, Madras.

फार्म 4/FORM IV

[नियम 8 देखिए/(*See* Rule 8)]

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I, Dr G.P. Phondke hereby declare that the particulars given above are true to the best of my knowledge and belief.

Sd/- G.P. Phondke

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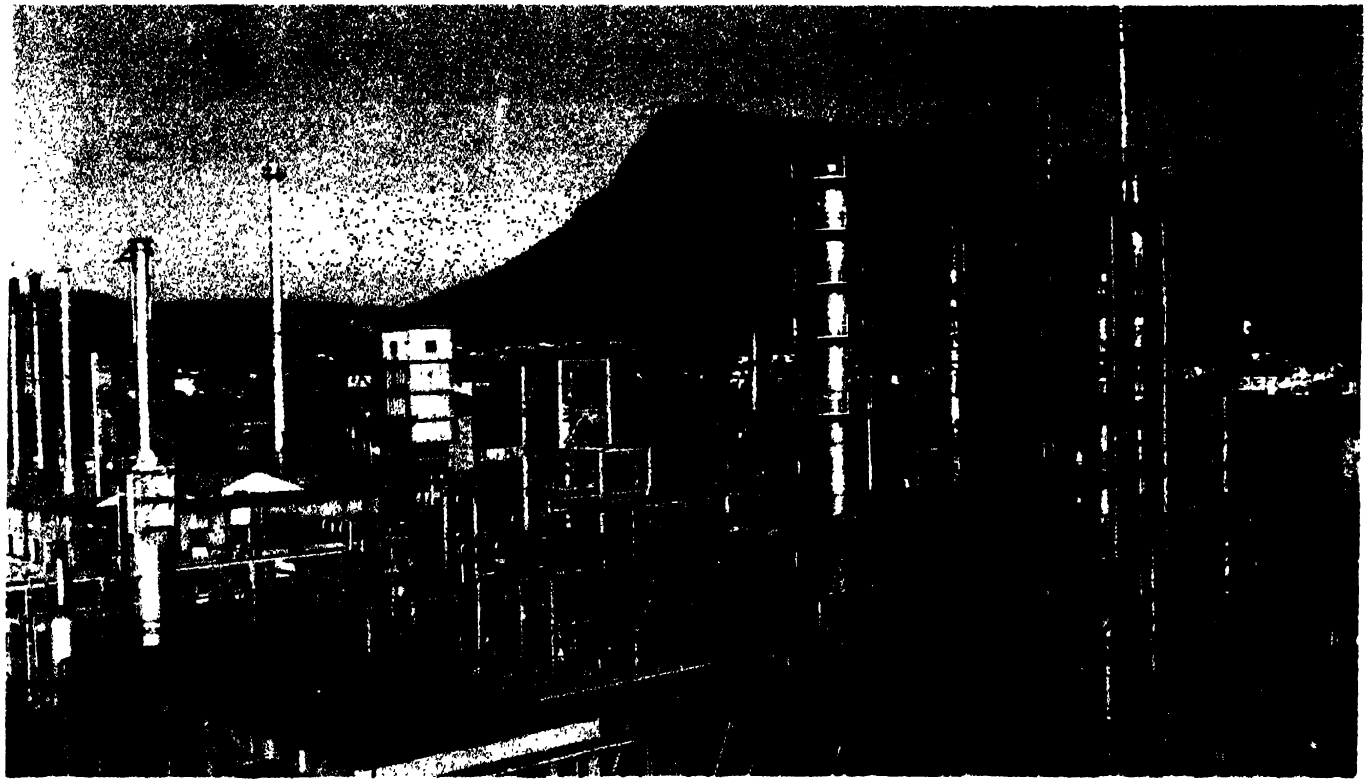

Hindustan Polymers' 12,000 tonnes/annum ethylbenzene plant, based on Albene Technology developed by NCL-Pune and HP, at Visakhapatnam (p 62)

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NCL-HP Albene Technology Commercialized

The Hindustan Polymers, a unit of McDowell and Co. Ltd of the United Breweries Group, has commenced commercial production of ethylbenzene from ethyl alcohol and benzene in their 12,000 tonnes/annum plant at Visakhapatnam, Andhra Pradesh. The technology, based on a special zeolite catalyst (Encilite-2), was developed by the National Chemical Laboratory (NCL), Pune, in collaboration with the Hindustan Polymers. Ethylbenzene is a key intermediate for styrene which is required for the manufacture of plastics and synthetic fibres.

At a press meet, held on 28 December 1989, Dr R.A. Mashelkar, Director, NCL, said that this was second major success involving the Encilite series of catalysts, the first being the xylofining technology for converting petrochemical feedstock to xylenes, commercialized at IPCL, Baroda, in 1986. These successes show the shift in research emphasis at NCL from imitative to innovative processes, in keeping with the demands of the time. In the current strategy at NCL, high quality basic research is blended with equally high order applied research to yield high-tech processes and technologies. The Hindustan Polymers was an enlightened and enterprising research partner, he said. It had absolute confidence in NCL's capabilities and was willing to take risks.

Shri R.C. Bhargava, President, Hindustan Polymers (HP), said that his company got in touch with NCL in 1985, as soon as it was known that it had developed a novel catalyst for production of ethylbenzene. Once convinced of its potentialities, HP had no hesitation in becoming partner in a joint venture. He stressed that imported technologies posed numerous problems and HP had adopted the NCL-HP technology as soon as it was ready. This technology is efficient, safe and leads to energy savings. The 12,000 tonnes/annum plant at Visakhapatnam has already produced 1500 tonnes of EB. HP has spent about Rs 10 million on plant design and there was little doubt that the profits would more than offset the investment.

Giving the details, Dr Paul Ratnasamy, Deputy Director and Head of the Catalysis Group that developed the technology, said that numerous catalytic processes were being worked out at NCL for petrochemical conversions. He said that three institutions were involved in the development of the Albene technology. NCL—the R&D organization which developed the catalyst; UCIL—which manufactured the catalyst for the user industry and HP—who manufactured ethylbenzene based on the Encilite catalyst This was a fine example of what could be achieved through such collaborations, utilizing expertise possessed by different organizations. Trials on the catalyst started at HP in 1986, and changes were made until the catalyst and the technology were ready for commercialization. The team con-

Salient Features of Albene Technology

- First such technology to be developed in India and possibly in the world, which uses ethyl alcohol directly for the production of ethylbenzene
- Single-step process for the production of ethylbenzene from ethyl alcohol and benzene, as against the conventional two-step process, where alcohol is first converted into ethylene and then reacted with benzene to give ethylbenzene
- The vapour phase reaction works at low temperature
- The single-step process saves 10% on alcohol as compared to the two-step process
- Ethyl alcohol can be used directly in concentration as low as 30%
- Can be engineered safely
- Cost and energy effective
- Encillite-2 catalyst is superior to the available catalysts/technologies which are based on reaction between ethylene and benzene
- Encilite-2 catalyst with marginal modifications can also be used with ethylene feedstock as well
- No toxic or corrosive chemicals are involved in the process
- Technology easy to operate
- Low investment
- Need for importing gaseous solvents and catalysts eliminated; this results in an annual saving of about Rs 10 million in foreign exchange
- Technology could be exported to the sugarcane-growing countries like Brazil, Cuba, Malaysia who produce a lot of alcohol based on sugarcane molasses
- As a result of the superiority of the Albene technology over the conventional technology, there will be an estimated saving of Rs 10 million on a production of 12,000 tonnes/annum of ethylbenzene, in terms of materials and energy.

sisted of about 45 scientists and engineers. Albene technology—the preparation of the Encilite catalyst and the production of ethylbenzene based on the catalyst—has been covered by patents.

The other technologies being developed include the one for the conversion of natural gas to kerosene and diesel. Natural gas will be a source of chemicals in future, and is certain to become more important than oil. This technology is futuristic, but it would be wise to invest in it, as it holds the promise of becoming economical in a decade or two. Grass-root commercial units based on it are expected to be set up by the mid-1990s. Besides producing the much needed kerosene and diesel, the technology would help utilize natural and low value olefins.

Studies are also being made to increase the LPG production. Addition of 1% of an NCL zeolite catalyst can raise the production of LPG by 2% and this would result in lakhs of additional LPG connections being made available

Shri S.K. Bhowmick, Vice President, HP (Operations), said that the full fledged commercialization of the Albene technology would start within six months. Highlighting the biggest advantage of the technology, he said that it used ethyl alcohol rather than ethylene, as the starting material. Use of alcohol developed from agriculture resources, is of great economic importance in India with a predominant agricultural base It is thus of great relevance to similar countries like Brazil, Cuba and Malaysia, which produce huge quantities of alcohol

The technology is wholly indigenous; not even a screw has been imported. HP would be quite willing to export the technology to other countries, Shri Bhowmick said

□

Workshop on Technological Change and Women Towards 21st Century

A workshop on 'Technological Change and Women Towards 21st Century' was held in New Delhi during 5-9 February 1990. It was organized jointly by CSIR through the National Institute of Science, Technology and Development Studies (NISTADS), New Delhi, and the Commonwealth Secretariat, with the objective of exchanging grassroot level experiences amongst the Asian countries in applying science and technology for solving the problems of women, and discussing how S&T can be more effectively used for meeting the basic needs of women in their day to day life. The workshop identified some steps that could be taken up to enhance the participation of women in scientific and technological activities, to involve them in all socio-economic activities so that they can take advantage of the changes taking place in science and technology. The aspects discussed in the workshop included: Technological changes and their impact on socio-economic and cultural activities of women; Policy and approaches for integrating science and technology changes into development programmes specially in relation to women; Technological assessment relating to agriculture, health, nutrition, education, family planning, occupational hazards, and the various targets in rural and urban development; Designing new technologies to suit women; Impact of information technology, biotechnology and other technologies on the life of and employment opportunities for women.

The workshop was inaugurated by Dr Arun Ghosh, Member, Planning Commission. Dr A.P. Mitra, Director General, CSIR, welcomed the delegates on behalf of CSIR. Prof. Abid Hussain, who was the Chairman of the Advisory Committee of the workshop, delivered the presidential address. The vote of thanks was extended by Shri K.N. Johry of CSIR. This workshop was an offshoot of the Commonwealth-sponsored workshop held in Dhaka, on 'Popularization of science and technology to enhance women participation', in October 1987.

Dr Ghosh in his inaugural address remarked that it is a matter of great regret that in India as well as in other countries, a woman is the most neglected creature. He pointed out that while women had made strides in various fields, including literature and science, there was still much to be done. Citing examples, he remarked that literacy amongst the women, specially in rural areas, was startingly low as also was the infant mortality.

Dr Emmanuel Apea from Commonwealth, also addressed the gathering. In his address he expressed the hope that the ideas and recommendations emanating from the deliberations of the workshop would be implemented by the concerned bodies.

Smt Ila Bhat in her keynote address said that though science and technology had made remarkable strides in recent decades, these had not brought about much change in the lives of women in developing countries. Pointing out that women were the first to be driven out of the economic activities and deskilled whenever some progress in science and technology was achieved, she emphasized that the technologies which are not appropriate for women are not appropriate at all.

About 40 participants from Bangladesh, Malaysia, Maldives, Singapore, Sri Lanka, Pakistan, Ghana Nigeria, Egypt, Iraq, Jordan, Thailand, New Zealand, Indonesia, Philippines, Nepal, Japan and Australia and 80 participants from India attended the workshop.

Workshop on 'Procurement Procedures' of World Bank

The World Bank, after extensive discussion with CSIR and other institutions and agencies, has initiated an Industrial Technology Development Project to enhance technology acquisition, development and commercialization capabilities in India. One component of the project seeks to finance technology institutions to upgrade/establish specific facilities to service industry for quality/productivity improvements through technological upgradation. In the first phase, four CSIR laboratories, viz. Central Leather Research Institute (CLRI), Madras; Central Mining Research Station (CMRS), Dhanbad; National Chemical Laboratory (NCL), Pune and the National Metallurgical Laboratory (NML), Jamshedpur, have together been sanctioned a loan of $ 12 million. In order to familiarize the loan recipient laboratories and other potential beneficiaries with the World Bank Procurement Procedures, the Technology Utilisation Division of CSIR organized a three-day workshop, during 12-14 February 1990, at the Central Road Research Institute (CRRI), New Delhi. About 30 representatives from 12 CSIR laboratories and other organizations, viz. BIS, SRIFIR, ICICI, ERDC and the Thapar Corporate Research & Development Centre, participated in the workshop, besides Mr Melwin Goldman and Mr Bernard Gouveia from the World Bank.

Welcoming the participants, Shri K. Subramanian, the then Internal Financial Adviser, CSIR, mentioned that the financial component of the project was $ 40 million, and thanked the World Bank for sending two senior personnel to the workshop to acquaint beneficiaries with its procurement procedures.

Shri N.J Jhaveri, DMD of ICICI, stressed the role of small companies in a developing country like India. He emphasized the role of R&D institutions for healthy growth of small companies and called for a greater interaction between these two. He said that this project of World Bank is a novel one and the first of its kind, and requested the technical institutions to make it successful.

Mr Goldman highlighted the dependence of the economic system on the technological talent available in a country. He observed that India had high level technical talent but it had not been able to deploy it in the most optimal and efficient manner. He further said that in order to help India achieve this, the World Bank had evolved this novel project. The project objectives would be directed to: (i) Support venture capital entities for financing technologically innovative and growth-oriented small enterprises; (ii) Assist technology service institutions (TIs), principally the research and standards institutes, to serve industrial needs, and industry to utilize the existing TIs for R&D work; (iii) Support the expansion of industries and their easier and rapid access to import of various forms of technology through the TDF. Mr Goldman stressed that World Bank, ICICI and CSIR should all work together for the success of this innovative venture in India.

This was followed by a series of lectures by Mr Bernard Gouveia, Regional Procurement Adviser of World Bank. Stating that the basic philosophy of procurement was to get what one wants at the minimum cost, Mr Gouveia explained how this could be done, with the help of case studies. Detailed discussion lectures ensued on procurement planning, packaging, limited international bidding, tender specifications, criteria for bid evaluation, etc. Mr Gouveia also explained the World Bank procedures for selection of consultants.

In the concluding session, Mr Gouveia discussed specific cases of procurement sought by the various loan recipient laboratories. The participants suggested that as there could be common items to be procured by the different insitutions, it will be advantageous to pool the procurement of such common items. It was further suggested that perhaps CSIR could co-ordinate this activity not only on behalf of CSIR laboratories but others as well.

Shri K. Subramanian welcoming the participants to the Worksh on Pr rement Procedures of World Bank

Second Annual Business Meeting on Technology Transfer and Marketing of CSIR Knowledgebase

The Technology Utilisation Division (TUD) at the CSIR Headquarters, New Delhi, has institutionalized the Business Meeting of laboratory personnel in charge of technology transfer and marketing of CSIR knowledgebase. The Annual Business Meeting is structured as a consultative mechanism to discuss issues, and to resolve problems pertaining to marketing of CSIR knowledgebase and to evolve a strategy for packaging of interlaboratory expertise and strengths. The meeting enables in arriving at functionally acceptable decisions on important issues pertaining to the business of technology transfer and marketing.

The second annual business meeting was held at the National Chemical Laboratory (NCL), Pune, on 30-31 January 1990. Over 55 participants from CSIR laboratories and PTCs participated. The discussions, spread over four sessions, covered: (i) Resolution of problems encountered in implementing the new guidelines; (ii) 'Model Agreements' for contracting sponsored, collaborative and consultancy projects and licensing of knowhow; (iii) Costing of manpower for contract research and consultancy; (iv) New avenues of marketing CSIR knowledgebase.

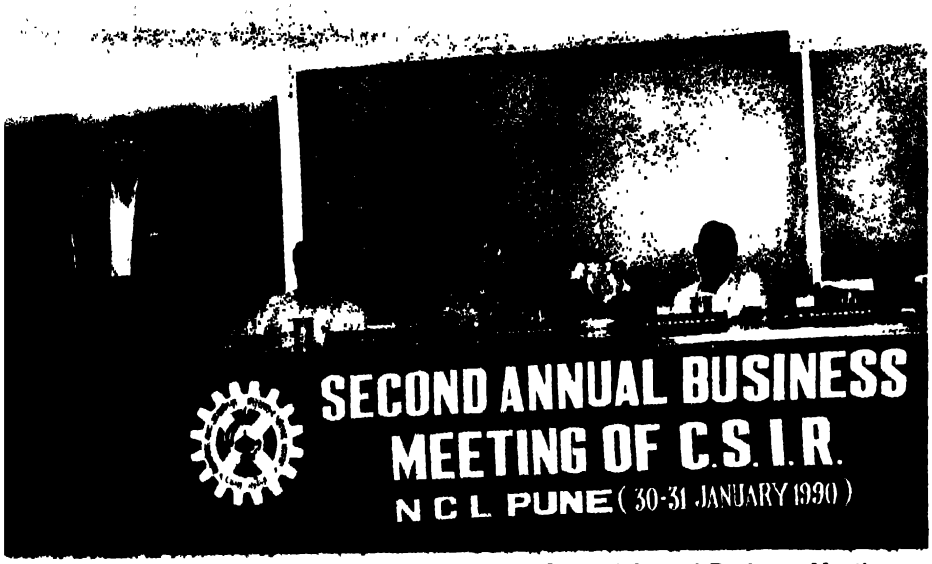
The meeting was inaugurated by Dr R.A. Mashelkar, Director, NCL. In his address, Dr Mashelkar appreciated the steps taken by TUD in providing the technology transfer and marketing personnel of CSIR a forum to meet, exchange views, discuss common problems, decide on solutions and above all, get the feeling of belonging to fraternity. He emphasized that CSIR needs to move away from the era of competence in R&D to international competitiveness in R&D; unless CSIR had a marketable knowledgebase, the marketing personnel could do little.

The first session inter alia enabled to resolve problems pertaining to collaborative research programmes, distribution of honorarium for consultancy, etc. The second session on drafting of legal agreements considered model agreement drafted by TUD. These were discussed threadbare for the adequacy and applicability to diverse situations and cases met within the laboratories. The session on costing of CSIR manpower was chaired by Shri K. Subramanian, the then Internal Financial Adviser, CSIR. Three presentations on costing of mandays based on project accounting were made by Dr K.S. Jauhri (IIP, Dehra Dun), Shri Narayana Murthy (NAL, Bangalore) and Shri T. Sambandam (SERC, Madras).

Dr Ram K. Iyengar, Additional Director General, CSIR, chaired the session on 'New Avenues for Marketing CSIR Knowledgebase', wherein Dr Paul Ranasamy, NCL and Dr G.P. Phondke, Director, PID, spoke on 'CSIR Knowledgebase in the Nineties' and 'Marketing of Information Services', respectively.

It emerged that unlike most other R&D agencies in the country, CSIR had to market its R&D knowledgebase in a commercial and competitive environment. This posed tremendous pressures and difficulties on choosing the R&D projects. Also, presently CSIR did not price its information services adequately. This component, if properly priced, could be a significant source of cashflow to CSIR. The overall suggestion was that CSIR should give adequate weightage and importance to marketing its knowledgebase.

The next annual business meeting will be held at the Indian Institute of Chemical Technology, Hyderabad.



Dr R.A. Mashelkar, Director, NCL, inaugurating the Second Annual Business Meeting on Technology Transfer and Marketing of CSIR Knowledgebase

CBRI celebrates Its Foundation Day

The Central Building Research Institute (CBRI), Roorkee, celebrated its Foundation Day on 10 February 1990 in the form of an 'Extension and Technology Transfer Day'. An Orientation-cum-Training Programme was organized at Roorkee for the extention scientists of the institute posted at Delhi, Bhopal, Ahmedabad, Calcutta, Hyderabad and Trivandrum. A

working programme was chalked out for an effective and meaningful transfer of CBRI technologies throughout the country, for the benefit of the poorer masses.

Dr R.K. Bhandari, Director, CBRI, while delivering the Foundation Day lecture declared that the Foundation Day of CBRI, in future, shall be celebrated as Extension and Technology Transfer Day and the Technical Get-together of the Extension Scientists shall be an integral feature of the Foundation Day celebrations. Dr Bhandari also inaugurated Festival Cricket Matches, organized on the occasion, between four teams.

Dr S.K. Misra, Deputy Director, CBRI, in his welcome address, highlighted the institute's contribution towards lowcost housing, during more than four decades of its existence. However, much more was needed to be done and how that could be achieved was deliberated upon by Dr R.K. Bhandari in his inaugural speech. He called upon the Extension Officers, who he said were the real ambassadors of the institute, to strive harder not only to extend the proven and innovative appropriate technologies but also to provide the necessary feedback for designing future R&D. Shri N.K. Shangari, Scientist Coordinator of Extension, CBRI, also addressed the gathering. □

Meeting of National Standing Committee on Plastics in Buildings

The fifth meeting of the National Standing Committee on Plastics in Buildings was held at Pune on 6 November 1989. The meeting was hosted by Dr Beck & Co., and chaired by Smt. I.K. Varma of IIT, New Delhi. Dr R.K. Jain, Convener, outlined progress of work since the last meeting.

Dr S.K. Bhatnagar and Dr B. Singh, Scientists, Central Building Research Institute (CBRI), Roorkee, made presentation on the progress of work on Data Bank on Plastics in Buildings. The committee decided to publish a document on the information compiled so far on Data Bank, for the benefit of users. Dr A.V. Pradhan of BUDCT, Bombay, made presentations on Recycling and Utilization of Plastic Waste and Fire Behaviour of Plastic Building Products.

In the post lunch session, Shri R.S Selunki of Dr Beck & Co. made a detailed presentation on Use of Epoxy Resin in Civil Engineering and Construction. Shri P.K. Jain, Scientist, CBRI, made a brief presentation on flooring tiles and application of PVC coating on mud walls.

The committee decided to publish monographs on different aspects of application of plastics in buildings, such as PVC Building Products, Epoxy in Construction, etc. The next meeting of the committee was decided to be held at the Indian Institute of Chemical Technology, Hyderabad, in July 1990. □

Studies on marine organisms affecting timber

Shri T.V. Raveendran, National Institute of Oceanography (NIO), Goa, carried out investigations on the marine organisms from offshore waters in Bombay High area, affecting timber. The researcher observed that timber undergoes considerable amount of destruction in offshore environments, depending on time, depth and duration of exposure. It is caused exclusively by the molluscan borers of the family Teredinidae. Eight species of borers were noticed, of which *Bankia carinata* dominated in terms of percentage destruction and *Lyrodus pedicellatus* in terms of numerical abundance. *Teredo navalis* was recorded for the first time from Indian waters. The occurrence of *T. navalis*, a species hitherto described as a temperate borer, is quite interesting. Its presence on the freshly exposed experimental panels indicates that the larvae of this species can even withstand the tropical marine conditions, and therefore, leave wide tolerance limits to the changing environments. The borer species exhibited particular depth preferences in their attack on wood. For example, *Bankia carinata* and *B. campanellata* dominated at 2 and 22m depths. *Lyrodus pedicellatus* at 42m and *L. singaporeana* and *Teredo parksi*, at 62m.

Studies on the length-diameter relationship in teredinid borers indicated significant correlation between these two parameters in all the species studied. However, the extent of correlation varied from species to species. Maximum correlation was observed in the case of *B. carinata* ($r = 0.92$) and minimum in *B. campanellata* ($r = 0.70$).

Fouling at the offshore station chosen for the study was found to be an year-round phenomenon. However, the intensity of settlement of foulers, their composition and the biomass build-up was found to be varying from month to month. The rich and diverse faunal assemblage noticed on the test coupons indicated that the offshore platforms could be potential grounds for fouling development. Not less than 60 species of foulers were recorded from the timber panels exposed at the station.

The most striking feature of the present study was the significant depthwise variations observed in biomass build-up and the faunal composition. While the panels exposed at 2 and 22m depths developed considerable extent of fouling, very low biomass values were recorded at 42 and 62m depths, despite the longer exposure duration of the panels. At 2m depth algal/hydroid dominance was noticed whereas at 22m, oysters predominated.

Biomass build-up on short-term (monthly) panels was very low compared to the coastal waters. At the same time, long-term panels, especially those exposed at 2 and 22m depths, developed considerable biomass, comparable to that of coastal waters.

An interrelationship was noticed between the settlement of foulers and the attack of borers. The panels exposed at 2 and 22m depths, which had the maximum fouling settlement, were subjected to lesser destruction. At the same time, the panels at 42 and 62m depths, which had lesser fouling, were found to have undergone maximum destruction. Probably, fouling cover might have protected the panels against the attack of borer larvae, either through predation or by avoiding their access to the wood.

Shri Raveendran worked under the guidance of Dr A.B. Wagh and was awarded Ph.D. degree by the Bombay University for his thesis based on the above investigations. □

PROGRESS REPORTS

CBRI Annual Report : 1989

The annual report of the Central Building Research Institute (CBRI), Roorkee, for 1989, brought out recently, shows that during the year under review 42 R&D projects, 94 consultancy services and 16 sponsored projects were taken up by the institute.

Thrust in the area of Building Materials during 1988 proved productive. Gypsum calcinator developed by CBRI won the NRDC Award. Several plants are expected to come up in different parts of the country. There has been an overwhelming demand for the calcinator technology from overseas too. Ferrocement door shutters which provide potential alternative to timber door shutters were brought to a stage of perfection and their commercial exploitation started. The Rajasthan Housing Board took up the technology for wide scale application in the state. Plastic and polymer composite doors and jute and coir bonded boards developed as a part of the thrust area programme also showed considerable promise. The polymer concrete trials on new building roofs provided further pabulum for research. The new concrete block technology was perfected and the Rajasthan Housing Board became one of the major users of the technology during the year.

The pilot plant established at the Bandel Thermal Power Station for production of cintered fly ash aggregate started production. The aggregate is likely to replace the more expensive natural aggregate in West Bengal.

CBRI's brick technology was appropriately packaged and the notable outcome during the year was the transfer of technology on wood fired brick kilns to Srilanka. The bricks produced by using CBRI technology were found to be of better quality than those produced by technology in vogue in Srilanka.

The success of clay fly ash bricks technology was demonstrated in New Delhi through the joint efforts of CBRI and CPWD. About 48,000 clay fly ash bricks containing 25% fly ash were produced at the CPWD kiln site in New Delhi. Fuel saving of 15% was recorded and the average crushing strength and water absorption values of clay fly ash bricks were comparable with controlled bricks made without fly ash.

CBRI in collaboration with the Regional Research Laboratory (RRL),Bhopal, developed $2 \times 1 m^2$ corrugated roofing sheets in their pilot plant. The raw materials used are sisal fibre, chicken mesh, sand and cement. These were tested for various physical properties, e.g. breaking load 3.0-3.5 kg/cm^2, water absorption 12-15% and weight 20-22 kg/m^2. A small shed was constructed at RRL, Bhopal, premises to assess their durability. Accelerated durability tests were in progress.

Gypsum binder and glass fibre composites of size $250 \times 250 \times 12$ mm^3 were produced by spray suction technique in the laboratory. The length and content of glass fibre was optimised and it was found that flexural strength of composites significantly increased with the use of FGP 26, length 50 mm, E type glass fibres. With 4 wt% of glass fibres, the composites bulk density was 1.641 g/cc, flexural strength 22 N/mm^2, impact strength 18 N/mm^2, water absorption 18% (24 h) and thermal conductivity 0.09 kcal/m/h/°C, at 28 days of curing in high humidity (90%r.h. or more). Studies on the effect of polypropylene fibres with glass fibres on the properties of composites, their durability and use of water miscible polymers in composites were in progress.

The institute carried out studies for making facing and flooring tiles from the Delhi china clay waste. The study showed that the recovery of fine china clay from quarried mineral is about 45%, and the waste comprises particle size higher than I.S. sieve 20; the dominant minerals are kaolinite, quartz and mica. A mixture of 30% of grounded felspar waste passing sieve number 8, 70% of china clay waste, and 15-18% of water was screw pressed to produce tiles of size $20 \times 20 \times 1$ cm^3. These tiles were dried in shed, and fired in electric muffle furnace at 1150°C for an hour. Later they were tested as per I.S. 1478-1969 and rated as first class tiles. The institute also developed ceramic colours and glazes, and decorative patterns for tiles. Both dark and light shades of black, green and blue ceramic colours besides white and tan colours, along with light hues of orange and yellow, were developed.

The first calcium silicate brick plant using CBRI technology was on its way at the DVC Establishment in Durgapur. CBRI's constant follow up of work relating to utilization of fly ash led to the drafting of what ought to be the national policy.

The Navodaya Vidyalaya Project posed an unprecedented challenge to the scientists of the institute. It provided an outstanding opportunity to produce tailor-cut designs in tune with geo-climatic conditions, local materials, traditional skills and above all, national concern for economy without compromising on durability or functional efficiency. Two hundred sixteen sites were surveyed in 20 states and

union territories; geotechnical investigations were completed at 213 sites and master plans were finalized for 182 NV complexes. Nearly 100 NV complexes had come to a decisive stage of completion.

For quickly, economically and reliably assessing the quality of piles and monitoring the behaviour of piles during driving, a computerized stress wave measuring equipment—Foundation Pile Diagnostic System (FPDS), TNO-IBBC, was procured and checked in the laboratory. Also field tests were carried out at six piling sites: four in Delhi, one at Ghaziabad (U.P.) and one at Kakinada (A.P.). At Kakinada, a large number of precast concrete piles were being driven to support various structures of a fertilizer plant. The four sites in Delhi included three sites of bored cast-in-situ concrete piles and one of driven cast-in-situ concrete piles. At Ghaziabad, a large number of bored cast-in-situ concrete piles including large diameter bored piles were being constructed to support various structures of a thermal power plant.

The institute has done pioneering work in the field of Fire Research. As a result, the industry is sponsoring studies in a big way, particularly relating to evaluation of fire proof cabinets, strong room doors, new building products, cables, etc.

A new quasi stationary flame front technique was developed for measurement of flame spread rate of combustible materials. In this simple yet reliable method, the flame front is allowed to remain within narrow limits of gradient of external radiant heat flux and most of the drawbacks of other standard techniques like BS, ASTM, AS and ISO, etc. are eliminated. The technique enables the determination of flame spread rate of building materials under steady state conditions at discrete levels of external radiant heat flux. The results are expressed in scientific units. The new technique, developed at CBRI in collaboration with the University of Roorkee, is more accurate and has direct relevance to practical fire situations. It will be useful in determining flame spread rate of different building materials.

A fire retardant treatment for wood and its component was developed based on reactive flame and glow retardant, dehydrating agent corrosion inhibitor and fungicidal agent, available indigenously. A pilot plant on Vacuum Pressure Impregnation (full cell process) for the chemical impregnation into wood was set up and a unit for drying and curing impregnated wood fabricated. A large number of wooden specimens of both small and full size doors, windows and partitions were rendered fire retardant by employing the vacuum pressure impregnation technology.

Use of wood-based panel products like plywood, particle boards and fibre board, etc. is increasing each day. Two main problems in the use of these materials are the combustible nature of the product and high cost of the adhesives, e.g. synthetic resins, viz. urea formaldehyde (U.F.) and phenol formaldehyde (P.F.). Attempts were made at CBRI to develop lignin-based resin (by substituting different amounts of phenol by lignin) having fire retardant properties. Fire retardant resins were prepared by condensing lignin, phenol formaldehyde and fire retardants. Different ratios and concentrations of ingredients, effect of time temperature and *p*H of the reaction were tried. Suitable conditions for the reaction and ratio of the ingredients were optimised.

Sandwich type plastic composite panels using PE/PU and MC/PU IPN foam as core and PW as surfacing material of improved fire characteristics were prepared in the laboratory and tested. Efforts were made to improve control on density and thickness of panels. Toxicity test was planned.

A six mould vibratory system with two 0.25 kW vibrators of frequency 3000 VPM was developed and fabricated last year for casting concrete blocks. The system was successfully tried for casting concrete blocks with aggregate 10 mm and less and also for casting stone blocks. The system however, could not be satisfactorily used for casting solid concrete blocks with aggregate 50 mm or more in size and with reduced water-cement ratio, 1.00 or less. Therefore, a full size prototype block casting machine was fabricated with increased capacity of the vibrating system. The machine is of egg-laying type and gives six blocks (19 cm in height and 14 cm in width) in each stroke. It was successfully used for casting solid concrete blocks with aggregates 50 to 60 mm and mixes 1:9:7 and 1:10:8, with water-cement ratio kept at 1.0 as against 1.2 to 1.3 in manual casting.

The Mathematical Modelling Group of the institute intimately interacted with C-MMACS, NAL. Projects on slopes stability and forecasting of landslides; application of optimization techniques in architecture and planning; optimal design of buildings were proposed to NAL, and the group developed IBM compatible software: Pascal package to determine the global optimal solution of a non-linear optimization problem; FORTRAN package to determine the global optimal solution of a non linear optimization problem; FORTRAN programme to fit a non-linear algebraic, exponential or logrithmic least square curve fit; FORTRAN programme to generate uniformly distributed random numbers; and FORTRAN package to compute the plastic deformation of a rock wedge under seismicity.

During the year, 11 papers were published, and 45 papers were presented at various conferences/seminars.

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NEW PUBLICATIONS

Statistics and Truth — Ramanujan Memorial Lectures

CSIR instituted in 1987, the 'CSIR Distinguished Lectures' scheme under which eminent scientists from India and abroad are invited to deliver lectures on topics of their choice. Each scientist delivers a series of three lectures at three different places in the country. The first series of lectures, delivered by Prof. C. Radhakrishna Rao, National Professor, India and Eberly Professor of Statistics, University of Pennsylvania, USA, was dedicated to the memory of the mathematics genius Srinivasa Ramanujan. The lectures and the places where they were delivered are: Uncertainty, randomness and creation of new knowledge (National Physical Laboratory, New Delhi); Principles and strategies of data analysis (Indian Statistical Institute, Calcutta) and An inevitable instrument in search of truth (Central Leather Research Institute, Madras).

The scope of these lectures was wide and prevaded many areas of human activities, both scientific and administrative.

The title publication is a compilation of these three lectures.

The publication (edited by Dr Y.R.K.Sharma of the Indian Statistical Institute, Calcutta; pp 143, price Rs 100) can be had from the Sales & Distribution Officer, Publications & Information Directorate, Hillside Road, New Delhi 110012. □

TRAINING COURSES

Orientation-Cum-Training Programme for Engineers & Architects of ESD, CSIR

The Central Building Research Institute (CBRI), Roorkee, organized an Orientation-cum-Training Programme for 16 Senior Engineers & Architects of the Engineering Services Division (ESD), CSIR, from 22 to 24 January 1990 at CBRI, Roorkee. The objective of the programme was to impart information about the recent developments in materials, planning and construction technology with particular reference to innovative methodologies for creation of special indoor-environments and for enhancement of functional efficiency of the buildings. Comfort of the occupants of the building enclosures, which also includes illumination, heat, light and acoustics, was given a prominent stature in the deliberations of the orientation programme. With CBRI as the venue of this programme, it was possible to have a fruitful interaction of the participants with the protogonists of different innovative technologies and the scientists working in the multi-disciplinary fields of housing and building.

Senior Engineers and Architects of the Engineering Services Division, CSIR, being shown working of the newly developed concrete block-making machine at CBRI

Fifteen special lectures were delivered by scientists of CBRI. Relevant live demonstations, laboratory exposition, field visits and group discussions centered round the real field problems.

The following presentations were made (write-ups on these are included in a bound lecture volume): Economical Foundations in Difficult Soils, Lowcost Construction Techniques for Mass Housing, Research and Development in Lowcost Building Materials, Preservation of Monumental Structures, Improved Bricks and Tiles from Inferior Soils, Architecture and Planning Guidelines for Housing Complexes and Townships, Design for Efficient Lighting of Buildings, Functional Design of Buildings with respect to Ventilation, Design Guidelines for Comfort in Buildings, Protection of Structures against Seismic Forces and Suitability of CBRI Prefabrication Technology in Seismic Zones, Design of Reinforced Concrete Members, Selection of Economical Specifications through Life Cycle Cost Analysis, Plastics and Polymers as Alternative Building Materials, Fire Safety in the Design and Construction of Buildings, Building Fires—An Overview, Role of Computers in Lowcost Housing Design, Computer-controlled Geotechnical Laboratory Triaxial and Consolidation Testing Systems and Modern Equipment for Geotechnical Investigations for Sub-surface Profiling and Landslide Control.

Dr S.K. Misra, Deputy Director, CBRI, during the inaugural and valedictory functions of the programme, laid emphasis on the need of learning and constantly updating one's infor-

mation, particularly in a field like building and housing which has a direct and long time concern with not only the physical comfort but also the emotional, psychological and even spiritual development of personality of the occupants of these creations. □

Get-Together-cum-Orientation Programme for Extension Officers of CBRI

A Get-together- cum- Orientation Programme was arranged for the Extension Scientists of the Central Building Research Institute (CBRI), Roorkee, on 9-10 February 1990. Scientists Incharge of the CBRI Extension Centres in Calcutta, Delhi, Ahmedabad, Trivandrum, Hyderabad and Bhopal, participated in the get-together. Keeping in view the main objectives of the programme, the scientists were exposed to all the important R&D outputs that had emerged at the institute in the recent past. Detailed deliberations were held in the following sessions: Exchange of information with the Extension Team and other scientists at CBRI Headquarters, Exposure to recent research & development fit for immediate transfer; Exposure to new facilities and laboratories; New expertise that has been developed and which can be readily utilized in the field; Interaction with scientists, project leaders, heads and the Director on different aspects of technology, feedback and developments, and Discussions and exchange of information with administrative wing of the institute including, Controller of Administration, Senior Finance & Accounts Officer, Administrative Officer, Stores & Purchase Officer and the Section Officers, for streamlining the administration and establishment aspects of the various centres in order to make them more effective .

The '35-point programme' of the government was treated as the central theme for various discussions during all the technical deliberations and a number of technologies and systems were identified, which could help provide affordable housing for poor, particularly those below the poverty line, whether in urban, rural or tribal regions

The importance of the Navodaya Vidyalaya Project and the involvement of the Extension Officers at different stages was stressed upon by the Director, CBRI.

In the process of transferring newer information, stress was laid on the following: inter-penetrating network polymers for corrosion resistance, composite door shutters and ferrocement door shutters as substitute of timber, analytical facilities for environmental improvement, land slide monitoring and sub-surface profiling, and production of clay lining tiles, solid concrete blocks and gypsum in improved calcinator. □

Training Course on Application of Instrumentation in Materials Research

The Central Building Research Institute (CBRI), Roorkee, organized a one-week training course on Application of Instrumentation in Materials Research, during 4-9 December 1989. The course was designed as an orientation programme on the application of instrumentation, for scientists working in R&D organizations of the country. The following instrumentation techniques were included in the course programme: Atomic absorption spectrophotometry, Inductively coupled plasma technique, UV, visible and IR spectrophotometry, Thermogravimetric characterization, microscopy and X-ray diffraction & X-ray fluorescence.

Dr S.R. Gowariker, Director, Central Scientific Instruments Organisation (CSIO), Chandigarh, while inaugurating the course, highlighted the importance of application of instrumentation not only in improving the quality of research but also in the development of newer materials. He briefly spoke about the new generation instrumentation in the field of materials research and also the role played by CSIO in the development of new instrumentation in this field.

Shri Kuldeep Chandra, General Manager, KDM Institute of Petroleum Exploration, Dehra Dun, delivered a keynote address on the Role of Instrumentation in Materials Research. In this address he discussed as to how the various physical properties of materials have formed the basis of a large number of instrumentation techniques which have resulted in fast advancements in the field of materials science and technology. He also gave an overview of high technology sophisticated computerized instruments with wide applications range, which already exist and are commercially available.

Dr R.K. Bhandari, Director, CBRI, while welcoming the Chief Guest and participants, spoke about his institute's attempts towards application of instrumentation in all fields of building research, including materials science.

The course was attended by 37 participants from various organizations, universities and engineering colleges. □

CBRI Visit-cum-Orientation Programme for Participants of International Human Settlement Workshop

The Central Building Research Institute (CBRI), Roorkee, organized a one-day Visit-cum-Orientation Programme on 7 February 1990, at the instance of Human Settlement Management Institute (HSMI), New Delhi, for delegates participating in the International Human Settlement Workshop at HUDCO, New Delhi, from the following organizations: Tamil Nadu Housing Board, Tamil Nadu Slum Clearance Board, D.D.A., U.P. Housing Board, A.P. State Housing Corporation and Madras Metropolitan Authority.

Visiting officers were shown round the various laboratories, pilot plants and demonstration sites in CBRI and were oriented to appreciate the necessity to utilize innovative technology in various aspects of the Human Settlement and Shelter Programme.□

DEPUTATION BRIEFS

Dr Palle Saibaba

Dr Palle Saibaba, Coordinator, Experimental Animal Production Facility, Central Food Technological Research Institute (CFTRI), Mysore, was deputed to UK by the Government of India, for one year (Sep. 1988-Oct. 1989) for the M.Sc. degree course in the Laboratory Animal Science with specialization in Histopathology at The Royal Veterinary College, University of London, London. The deputation was sponsored by the British Council under CSIR-British Council Fellowship Exchange Programme (Colombo Plan)

Dr Saibaba undertook a project at the Department of Veterinary College, University of London, entitled 'Effect of light intensities on the oestrous cycle and ovulation in pigmented and albino mice' and submitted a dissertation on the project to the University of London. He is the first Indian student to have studied this course at the University of London.

During his deputation, Dr Saibaba also visited various renowned institutions/laboratories and medical schools in UK, engaged in the toxicological/safety evaluation of foods, drugs, food additives, agrochemicals, pesticides, etc. as a part of his M.Sc. programme.

Dr S.B. Halligudi

Dr S.B. Halligudi, Scientist, Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar, visited USSR for a period of six months from 27 April to 31 October 1989 under the Integrated Long Term Programme of Cooperation in Science & Technology (ILTP) between India and USSR. He worked at the Institute of Catalysis, Novasibirsk in the area of Fischer-Tropsch Synthesis (LT/A-4.4) on ruthenium metal based supported catalysts system for low pressure vapour phase hydroformylation of propylene to obtain butyraldehydes. He also visited Zelinsky Institute of Organic Chemistry (ZIOC) and the Institute of Organo Element Compounds (IOEC), Moscow and discussed the future plans of collaborative work with the concerned scientists.

Dr M. Noel

Dr M. Noel, Scientist, Central Eletrochemical Research Institute (CECRI), Karaikudi, was deputed to FRG under the INSA-DFG Exchange of Scientists Programme, for 3 months from 1 August 1989, to get training on 'Electrochemical Fluorination', at the University of Duisburg.

Dr R.P. Rao

Dr R.P Rao, Scientist, CECRI, Karaikudi, chaired a session and presented two papers in the Second International Symposium on Rare Earth Spectroscopy, held in China during 9-14 September 1989.

Shri S. Krishnamurthy

Shri S. Krishnamurthy, Scientist, CECRI, Karaikudi, was deputed to Czechoslovakia for 12 weeks from 7 September 1989 under the S&T Cooperation Programme between CSIR and the Czechoslovakian Academy of Sciences. He studied the use of porous carbon electrodes as oxygen depolarizing cathode in membrane cell as well as in the fuel cell concentrator, at the Institute of Inorganic Chemistry, Prague.

Dr D.C. Trivedi

Dr D.C. Trivedi, Scientist, CECRI, Karaikudi, was deputed to Japan for four weeks from 17 October 1989 under the Exchange of Scientists programme between the Indian National Science Academy (INSA) and the Japan Society for Promotion of Science. The purpose of his deputation was to study various aspects of organic superconductors and conducting polymers. He visited the Kyoto Okayama and Osaka universities, University of Tsukuba and the Tokyo University of Agriculture and Technology. □

Honours & Awards

Prof. S.K. Rangarajan

Prof. S.K. Rangarajan, Director, Central Electrochemical Research Institute (CECRI), Karaikudi, has been elected as a Corresponding Fellow of the Third World Academy of Sciences (TWAS).

Dr Ved Ram Singh

Dr Ved Ram Singh of the National Physical Laboratory (NPL), New Delhi, has been awarded the Institution of Engineers (India) Prize of 1988-89 for his research paper, 'Advances in Ultrasonic Instrumentation for Use in Forensic Medicine published in *Journal of Institution of Engineers*, 69 ID-2 (1989), 21. The prize carrying a certificate and a cash award of Rs 2500 was presented to Dr Singh at the inaugural session of the Fourth Indian Engineering Congress held in Bhubaneswar on 31 December 1989.

Dr Ahmed Kamal

Dr Ahmed Kamal, Scientist, Organic Chemistry-I Division, Indian Institute of Chemical Technology, Hyderabad, has been adjudged as the co-winner of the 'Young Muslim Scientist Award—1988' in Physical Sciences Group, by the Muslim Association for the Advancement of Science. □

PATENTS FILED

1105/DEL/89: An apparatus for automatic extinguishment of flammable liquid fires in fixed/floating roof oil storage tanks by dry chemical powder (DCP) fire extinguishant, T.P. Sharma, B.B. Lal, J. Singh and R.S. Chimote—Central Building Research Institute, Roorkee.

1106/DEL/89: An apparatus for automatic extinguishment of flammable liquid fires in fixed/floating roof oil storage tanks by injecting foam, T.P. Sharma, B.B. Lal, J. Singh and R.S. Chimote—Central Building Research Institute, Roorkee.

1107/DEL/89: A fixed roof type flammable liquid storage tank, T.P. Sharma and R.S. Chimote—Central Building Research Institute, Roorkee.

1108/DEL/89: A process for the production of spheroidized high strength low alloy (HSLA) steels for soft magnetic applications, S.P. Narayan, V. Rao and O.N. Mohanty—National Metallurgical Laboratory, Jamshedpur.

1109/DEL/89: A process for the production of spheroidized high strength low alloy (HSLA) steels for soft magnetic applications, S.P. Narayan, V. Rao and O.N. Mohanty—National Metallurgical Laboratory, Jamshedpur

1110/DEL/89: The preparation of cadmium selenide films by a selective plating technique, S.K Rangarajan, K.R. Murali, V. Subramanian, N. Rangarajan and A S. Lakshmanan—Central Electrochemical Research Institute, Karaikudi.

1111/DEL/89: A process for the production of β-picoline and pyridine from acetaldehyde, formaldehyde and ammonia, S.K. Roy, K.P. Sharma, B. Ghosh, S.K. Roy, J. Das, T.K. Goswami and R. Haque—Central Fuel Research Institute, Dhanbad.

1112/DEL/89: A process for the production of an extreme pressure industrial gear oil using sulphurized jojoba oil, G.A. Pillai, Sivasankaran, R.P. S. Bisht, V.K. Bhatia, M. Kashyap and S.K. Chibber—Indian Institute of Petroleum, Dehra Dun.

1168/DEL/89 : A process for the preparation of 1-(1,5-dimethyl substituted)-hexyl-4-methylbenzenes from zingberene, A.N. Menon and J.M. Rao—Regional Research Laboratory, Trivandrum.

1169/DEL/89: A process for the preparation of a novel porous crystalline material, M.K. Dongare, J.S. Reddy, P. Ratnasamy and P. Singh—National Chemical Laboratory, Pune.

1170/DEL/89: A process for the production of a novel flux useful for the production of zinc based alloys and a process for the production of such alloys using the flux, C.S. Sivaramakrishnan, R.K. Mahanti and Kishori Lal—National Metallurgical Laboratory, Jamshedpur.

1171/DEL/89: An improved process for the production of alloys, C.S. Sivaramakrishnan, R.K.Mahanty and Kishori Lal—National Metallurgical Laboratory, Jamshedpur.

1172/DEL/89: A process for making low tungsten high speed tool steels, R.K. Dubey—National Metallurgical Laboratory, Jamshedpur.

1173/DEL/89: An improved process for making resin bonded alumina graphite refractories, K.K. Singh, K. Ray and N.N. Mathur—National Metallurgical Laboratory, Jamshedpur.

1174/DEL/89: Improved process for ultrafine grinding of non-oxide and other ceramic materials, J. Mukerji and S. Ghatak—Central Glass & Ceramic Research Institute, Calcutta.

1175/DEL/89: An equipment for indirect cooling or heating coupled with mixing of granular crystalline or powdered solids, R.N. Parlikar and B. Vasudeva—Indian Institute of Chemical Technology, Hyderabad.

1180/DEL/89: An improved process for manufacture of precipitated silica at ambient temperature using hydrochloric acid, H.M. Mody, V.M. Sheth and V.P. Pandya—Central Salt & Marine Chemicals Research Institute, Bhavnagar.

1181/DEL/89: A house hold filter for the removal of micro-organism and other pollutants from drinking water sources, R.K. Sharma, S. Kumar and P.K. Ray—Industrial Toxicology Research Centre, Lucknow.

1182/DEL/89: A control system for control of emission through chimneys/ovens by application of water/steam, P.K. Nair and B. Singh—Central Mining Research Station, Dhanbad.

1183/DEL/89: An improved process for the production of rose oil, A.P. Kahol—Central Institute of Medicinal and Aromatic Plants, Lucknow.

1230/DEL/89: An improved process for the roasting of wolframite concentrate with soda ash, B.V. Ramanmurthy, G.N. Srinivasan, A.K. Jouhari, D.N. Dey, P.K. Jena—Regional Research Laboratory, Bhubaneswar.

1231/DEL/89: An improved process for the conversion of methanol to olefinic hydrocarbons, P. Ratnasamy, B.S. Rao, A.J. Chandwadkar, I. Balkrishnan, R.A. Shaikh—National Chemical Laboratory, Pune.

1232/DEL/89: A process for preparation of pharmaceutical composition with enhanced activity for treatment of tuberculosis and leprosy, Usha Zutshi, K.L. Bedi, G.B. Singh, R.K. Johri, S.K. Dhar, J.K. Kaul, S.C. Sharma, G.S. Pahwa, Naveen Kapoor, A.K. Tikoo, M.K. Tickoo, Uma Kaul, R.K. Zutshi, Rajinder Singh and Surjit Singh—Regional Research Laboratory, Jammu.

1233/DEL/89: An improved process for the production of cumene, B.S. Rao, A.R. Pradhan, P. Ratnasamy—National Chemical Laboratory, Pune. □

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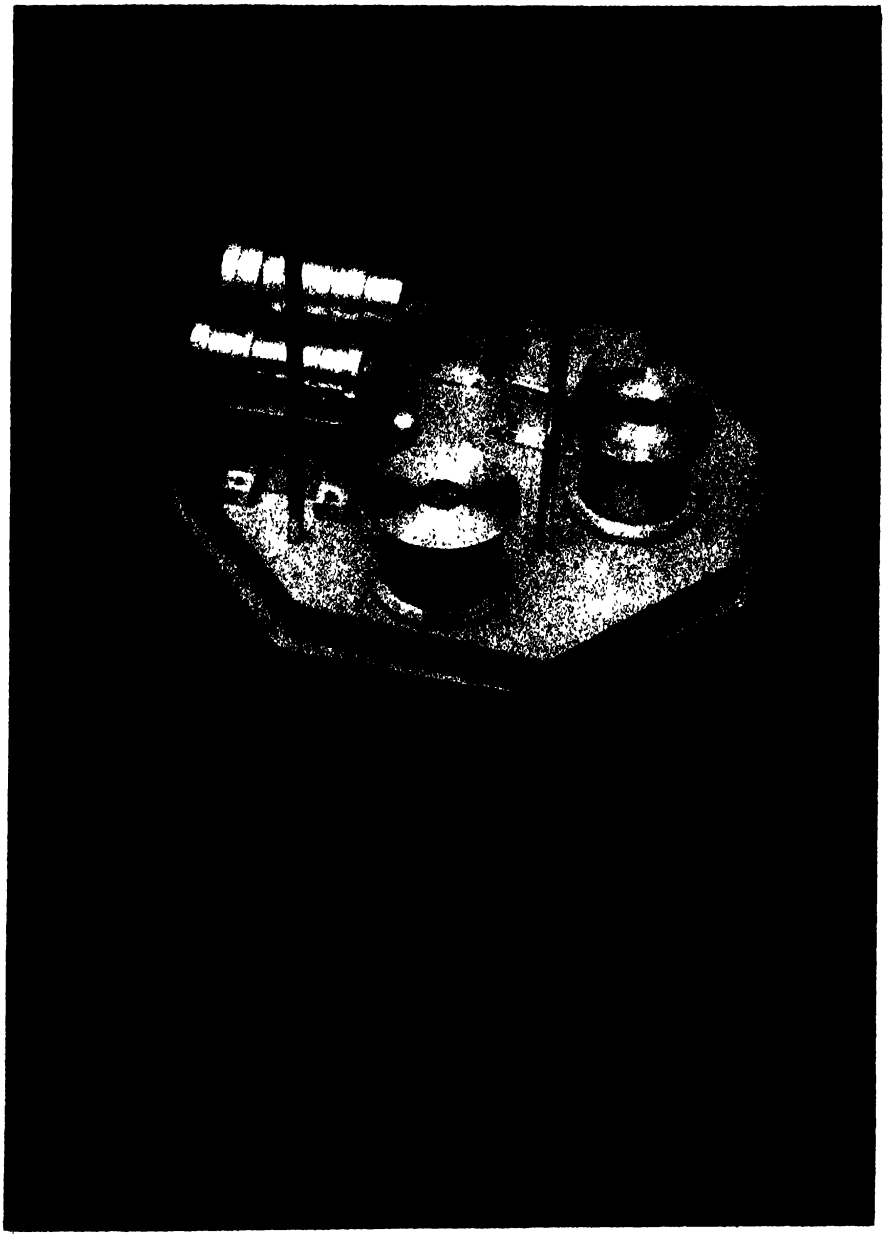

Model of the SROSS-C satellite to be launched by ASLV. It will carry NPL and ISAC payloads (p. 80)

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Fifth International Symposium on Acoustic Remote Sensing of the Atmosphere and Oceans

The National Physical Laboratory (NPL), New Delhi, organized the Fifth International Symposium on Acoustic Remote Sensing of the Atmosphere and Oceans', at NPL during 6-9 February 1990. The objective of the symposium was to bring together those engaged in remote sensing of the atmosphere and oceans using acoustic techniques, to review progress made in the field over the past few years and to improve, in general, the communication between workers in various research and application activities. About 70 delegates from 13 countries, viz. India, Japan, New Zealand, USA, USSR, China, West Germany, Italy, France, Greece, Turkey, Hongkong and Sri Lanka, participated in the deliberations of the symposium. About 60 papers, including 14 review/invited talks, were presented. The technical sessions covered: remote sensing techniques, ocean studies, boundary layer studies, acoustic sounding applications, and instrumentation. The remote sensing techniques included: SODAR, RASS, Mini SODAR, SONAR and other complementary techniques.

The symposium was held under the auspices of the International Society on Acoustic Remote Sensing, represented by Dr S.P. Singal, Scientist, NPL, as its Chairman. It was sponsored by 18 societies/academies/departments/institutions, including the International Centre for Theoretical Physics (ICTP), Trieste, Italy, which also provided financial support.

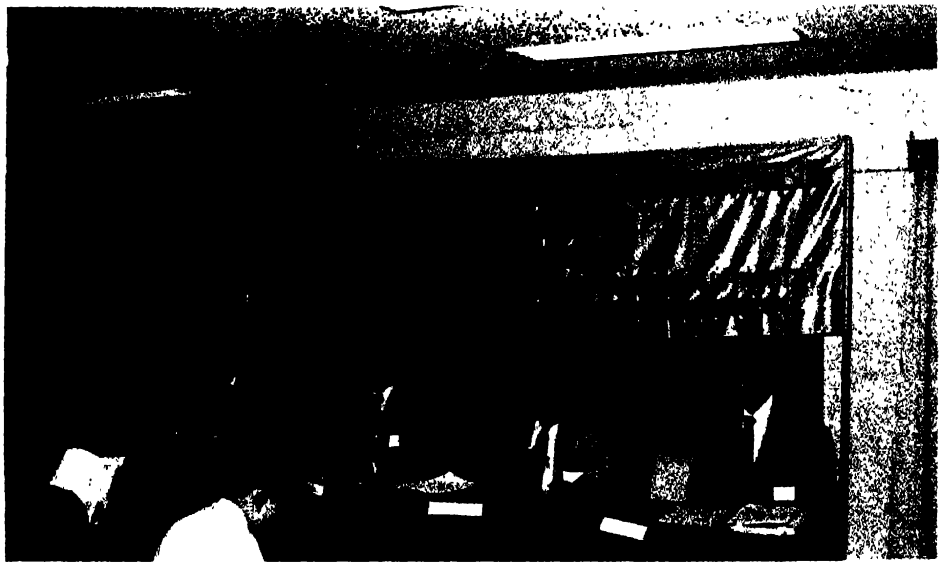
Inaugural Session

The inaugural session was chaired by Dr A.R. Verma, ex-Director, NPL. Dr S.K. Joshi, Director, NPL, welcomed the delegates and Dr A.P. Mitra, Director General, CSIR, inaugurated the symposium. Mr Alberto Cannetta, Scientific Attache, Italian Embassy, addressed the delegates, as representative of ICTP, and Dr Singal gave a brief background about the genesis of the international symposium which is held every two years in one of the active countries. A message received from Prof. Abdul Salam, NL, Director, ICTP, wishing success to the symposium and expressing hope for a more effective collaboration between NPL and ICTP, was read out.

Prof. Joshi in his welcome address, spoke about the CSIR system and the activities of his laboratory.

Dr Verma in his address said that the work on acoustic sounding (Sodar), a technique analogous to radar using acoustic waves, was initiated at NPL in 1971, as a collaborative effort between the Acoustics and Radio Science divisions, based on zero budget. The aim was to develop the technique for use in studies of wind shear, radiowave ducts, surface based inversion layer and mixing depth, etc. The feasibility of the technique, which was inexpensive but very powerful, could be established in a few months time and a prototype was set up in 1974. Later on, successful efforts were made to set up indigenously fabricated systems leading to the establishment of Sodar systems at the India Meteorological Department Observatory, Aya Nagar, Delhi and Micrometeorological Laboratories, BARC, Tarapur, for their calibration with radiosonde and tower observations in the boundary layer. Adding the Doppler facility, studies are now being made to find the use of acoustic sounding techniques in the areas of monitoring air pollution meteorology, communication ducts, wind shear, atmospheric boundary layer phenomena, air-sea interaction and turbulence structure in oceans.

Dr Mitra, in his inaugural address, recalled the long academic contacts with Italy through ICTP and CNR. He discussed broadly the policy of technology transfer, creativity in science and collaboration with various agencies even under non-umbrella situations. A few umbrella institutions which can be used for this purpose were named as ICTP, ICSU (International Council of Scientific Unions),



Dr S.K. Joshi, Director, NPL, delivering the welcome address. Seated on the dais (*from left*) are: Mr Alberto Cannetta, Scientific Attache, Italian Embassy; Dr A.R. Verma, ex-Director, NPL, Dr A.P. Mitra, Director General, CSIR, and Dr S.P. Singal, Scientist, NPL

ASAS (Asian Scientific Academies and Societies) and CSC (Commonwealth Science Council).

Speaking about the initial periods, Dr Mitra said that even with a low budget, academically high research in radio communication was carried out at NPL. He recalled the use of naturally occurring radiowave signals (radio noise) through the rhiometre to study the imprints of the ionosphere even before the period of International Geophysical Year (IGY). A few radio receivers at 22.3 MHz and 30 MHz were used which could give practically the same information as from any other system, at a very low cost. Sodar has also been one of the low budget but powerful techniques. In early seventies, before undertaking sodar techniques as one of the programmes, need was felt by the Defence to define and characterize the radio propagation medium in the tropospheric region. Only NBS 101 was available as model to work out the design of microwave and troposcatter links, which was not fully satisfactory. Radio refractivity obtained from Atlas was not able to give the desired resolution of ducting widths, a few tens of metres, needed to characterize the operation of troposcatter radars. Under these conditions, a programme was launched to set up satellite beacon system at low angle, microbarographs and sodar., The first sodar system assembled under this programme consisted of a solar astronomy 6 ft dish as the receiver antenna, loudspeaker array as transmitter, sand filled gunny bags as the receiver shield and the IMD borrowed fascimile recorder to display the received signals.

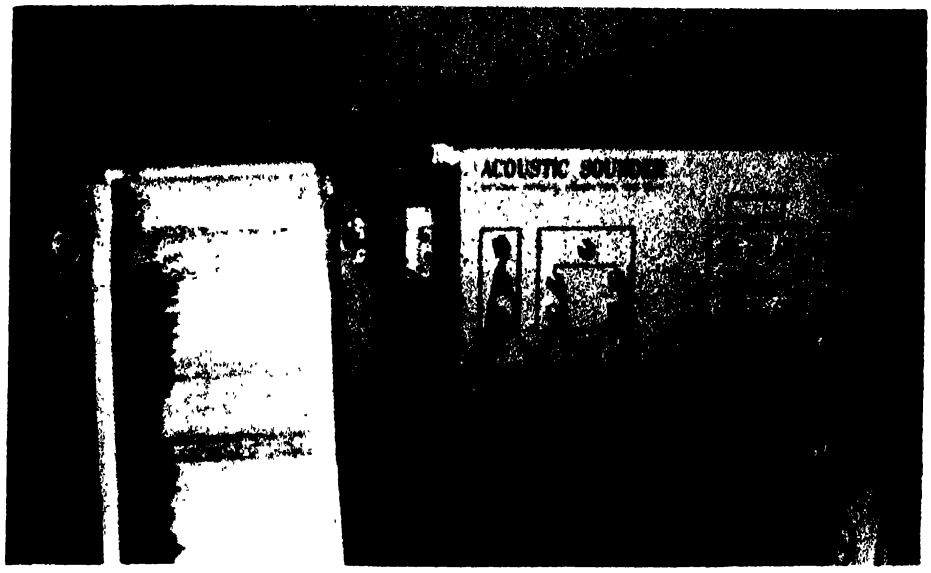
The initial experiments were very successful. A large scale atmospheric disturbance over a region of 500 km could be detected by the use of these systems. Calibration of the system was carried out with the help of slow rising balloon and with the 120 m instrumented tower of BARC. The presence of low level inversion layers were detected especially during winter months which could be responsible for air pollution hazards. These successes prompted VSSC, Thumba, to develop a 'Doppler Sodar', and a number of other centres to start work in this area.

Presently, need is being felt to carry out research in the field of ocean acoustics. Tomography used in the large emission mode is one of the rich areas to work upon. Ocean-imaging systems can be built to study El Ninos. Combined with other systems, both conventional and remote sensing, sodar can be used to study antarctic atmospheric boundary layer, air-sea interaction and monsoon climate. Dr Mitra particularly stressed the need to use acoustic waves as a supplementary/complementary tool in the form of monostatic sodar, Doppler sodar and RASS (Radio-Acoustic Sounding System), to characterize the lower troposphere in India and over the antarctic region. In this region, even MST radar which is going to be set up as one of the important major national facilities for the atmospheric scientists, will present a gap. FMCW, towers and balloons can be used in this region to a limited extent owing to their cost factor while acoustic waves can be extensively employed.

Dr Mitra also narrated the various projects being undertaken interfacing with those of International Geosphere Biosphere Programme. Ozone monitoring, substitution technology for CFC, green house molecule monitoring, effects on plant and marine life and climatology were mentioned as the areas of studies under this programme.

Towards the end of his address, Dr Mitra traced the genesis of the CSIR S&T programmes and told that 30-40% CSIR programmes are now mission mode. These missions are based on societal/national needs.

Mr Alberto Cannetta in his address, stressed the importance of international collaboration. Mentioning the collaborative programmes between Italian National Research Council (CNR) and CSIR, Mr Cannetta stated that international collaboration in S&T is essential for making advancements in science and for the economic progress of mankind. Italian science today is linked with economic development. Italian scientists had made significant contributions in science in the past and the tradition continues. Though individual effort and excellence still represent the mettle of any advancement in science, final results today depend largely upon invest-



Monostatic Sodar System at NPL, New Delhi

ment, management and above all on strong international collaboration.

Technical Sessions

The first technical session was a review of the potential, achievements and critical evaluation of the various acoustic remote sensing techniques (Chairmen: Prof. D.N. Asimakopoulos, Head, Department of Applied Physics, Athens University, Greece and Prof. D. Dutta Majumdar, Head, ECSU, Indian Statistical Institute, Calcutta). Prof. Alain Weill of CRPE, France, in his talk on mesoscale studies reviewed the studies on frontal systems, variability of fluxes, gravity waves and forested and complex terrain boundary, undertaken with sodar and other complementary instruments. Dr J.C. Kaimal of WPL, Boulder, USA, critically discussed the merits and basic limitations in measuring turbulence with sodar. The findings were presented in the light of the 1988 International Intercomparison Experiments. Dr G. Peters of Meteorological Institute, University of Hamburg, West Germany, discussed the use and complementarity of acoustic and other ground-based remote sensing techniques. He projected that RASS, a mixture of radar and sodar, can give both temperature and wind field in the first few kilometres of the atmosphere with high accuracy. Dr R.L. Coulter of the Argonne National Laboratory, USA, discussed the applications and potential of minisodar technology. He explained that use of high frequencies has led to small, lightweight enclosures, better velocity resolution and highly efficient transducer elements which have helped in making the studies of flow in the surface layer, within tree canopies and above complex terrain, of turbulence and precipitation characteristics.

The second technical session was devoted to the presentation of status reports (Chairmen: Dr Michael Jones of WPL, Boulder, USA and Dr D. Srinivasan, Emeritus Scientist, IIT, Madras). Prof. D.N. Asimakopoulos, in his paper, gave details of the design of the University of Athens' high frequency acoustic sounder system. He informed that unusual acoustic sounder modes of operation were used to match the experimental needs. Results of the study related to full-scale 2 MW and 50 kW wind turbines, and the coastal IBL experiments were presented. Dr D.S. Wratt of the New Zealand Meteorological Service, Wellington, described the processes governing the spread of pollutants in atmosphere and discussed the relevant uses of acoustic sounder information from the practical point of view of a meteorologist involved in consultancy and advisory work for industry and government agencies.

The third technical session was on instrumentation (Chairmen: Dr S.G. Bradley, Department of Physics, Auckland University, New Zealand and Dr R.L. Coulter). Dr R.G. Strauch of WPL, Boulder, USA, described the recent advances in RASS. He informed that wind profiler radars, particularly those with wavelengths of 0.5 to 4 metres, are better suited for RASS than any of the radars available during early RASS developments. Vertical profiles of virtual temperature could be measured in about one minute with this system alongwith measurements of vertical wind during the same time. Dr S.K. Srivastava of the India Meteorological Department, New Delhi, described the various direct sensing and remote sensing tools for meteorological measurements in the atmospheric boundary layer. He also dealt with their relative advantages and disadvantages. He stated that *in-situ* measurements are quantitative and reliable whereas remote sensing/probing techniques are relatively economical. He recommended a continuation of available remote and direct sensing tools for optimising the cost of the experiment and best use of the data set. Prof. D. Dutta Majumdar, in his review paper, presented a state-of-the-art overview of the nine atmospheric remote probing techniques alongwith the associated problems of data acquisition, storage, retrieval, analysis and application in modelling.

In this session, in addition to the invited review talks, 10 contributed papers were presented, which discussed: instrumentation problems and developments, techniques of determination of various parameters, preliminary results of the international sodar intercomparison experiment, long term intercomparison of temperature data measured by RASS and tower instruments, and algorithm development scheme for the machine recognition of sodar structures.

The subject of the fourth technical session was Ocean Studies Using Acoustic Remote Sensing Techniques (Chairmen: Prof. Alain Weill and Dr G. Peters). The invited paper of Clifford *et al.* presented by Dr T.M. Georges of WPL, Boulder, USA, dealt with the determination of fine scale structure of turbulent ocean medium by acoustic scintillation techniques. Recent progress in theoretical and experimental research on the use of the techniques for remotely probing the currents, turbulence and internal wave structure of the ocean, was described. Prof. D. Srinivasan in his review talk described the various acoustic techniques for characterization of the ocean waters with particular reference to the Indian seas. He pointed out that acoustic tomography technique is a powerful tool for visualizing the physical phenomena (such as eddies) in the sea. This talk was followed by a popular talk by Dr S.R. Rao, Emeritus Scientist, NIO, Goa, on the discovery of the legendary city of Dwarka in the Arabian Sea. He informed that this discovery is the result of painstaking research and underwater excavations. The lecture was followed by a video film exhibiting the research, underwater excavations and the findings.

The invited talks were followed by four contributed papers on: shallow ocean sediment characterization, chaos in underwater acoustics, French

programme on ocean-atmosphere energy transfer study and vertical slice ocean-acoustic tomography inversion-converting multi-loop measurements to single-loop data.

Boundary Layer Studies was the subject of the fifth technical . session (Chairmen: Dr R.G. Strauch and Dr T.M. Georges); 25 papers were presented in this session. In the opening paper, Rita Ocone of the Department of Physics, La Sapienza University, Rome, described the results of acoustic sounder experimentation in Victoria Land, Antarctica, using different sodar configurations. Several katabotic wind episodes and occasional strong signals associated with large negative values of the vertical velocities in the presence of snow precipitation were reported.

Following the invited paper, Dr R.L. Coulter made a presentation describing the use of minisodar to study the valley drainage flow in western Colorado, USA, during ASCOT' 88. Dr Li Shiming of China described the use of sodar to detect the boundary layer structure in the Beijing area. Christine Mazaudier of CRPE, France, presented three papers on: (1) Doppler sodar observations of the convective boundary layer during the Hapex-Mobilhy experiment, (2) Recent studies on the forested boundary layer using two Doppler sodars, and (3) Waves in the stable planetary boundary layer observed by Doppler sodars. Dr S. Incecik of Turkey gave a diagnostic and prognostic study of the atmospheric boundary layer. Dr Pan Naixian of China presented a paper on the deduction of temperature structure profiles from sodar echo intensity. Dr A.K. De of ISI, Calcutta, presented a paper on sodar structures related to gravity wave perturbations over Calcutta. Dr B.S. Gera of NPL presented papers on: Tropical boundary layer studies during monsoon period using sodar; Sodar studies of ABL at MGCC, Nagothane; Studies of ABL during a synoptic fog storm and Studies of structure parameters for a forward scattering sodar system. Dr K.N. Nair of VSSC, Trivandrum, presented surface layer studies using tower-based measurements at Thumba. A complementary paper on Characteristics of thermal internal boundary layer at Thumba was presented by Dr K. Sen Gupta of VSSC, Trivandrum. Shri D.R. Pahwa of NPL presented papers on Study of the evolution of nocturnal stable boundary layer of Delhi and Tropical sea breeze at Tarapur. Papers related to Monsoon Trough Boundary Layer Experiment were presented by Dr Malti Goel of DST, New Delhi and Dr K.G. Vernekar of IITM, Pune. Dr D. Narayana Rao of the S.V. University, Tirupati, described ABL studies over Tirupati using sodar. Dr M. Purnachandra Rao of the Andhra University, Waltair, presented papers on Acoustic remote sensing of coastal atmospheric boundary layer and case studies of sea breeze at Visakhapatnam.

The last technical session of the symposium was on Acoustic Sounding Applications. Dr S.P. Singal presented a review talk on air quality meteorological studies using sodar. In this talk the information about the ABL and mixing depth, available from acoustic sounder, was critically examined in the light of the various parameters defining the ABL height. The paper by Dr W.L. Chang of the Royal Observatory, Hongkong, closely followed the subject of the review talk. In his paper, Dr Chang outlined an experimental scheme for inferring mixing heights using acoustic sounding and routine observations. Dr J.C. Kaimal read the paper by W.D. Neff of WPL, Boulder, USA, on the use of sodar in urban air quality studies. They had used a minisodar to charcterize the stability of the atmosphere and provide hourly wind profiles. Dr S.L. Jain of NPL presented a paper on the monitoring of atmospheric minor constituents using laser heterodyne system. Dr A.B. Ghosh and Dr H.N. Dutta of NPL presented papers on use of acoustic sounders for communication links and Dr R. Venkatachari of NPL presented a paper on complementarity of acoustic sounding and microbarograph to study the atmospheric boundary layer.

Panel Discussions

The session was chaired by Prof. M.K. Das Gupta, Institute of Radio Physics & Electronics, Calcutta University. The panelists were: Dr J.C. Kaimal (USA), Dr R.G. Strauch (USA), Prof. D.N. Asimakopoulos (Greece), Prof. D. Srinivasan (India), Prof. Alain Weill (France), Dr D.R. Sikka (India) and Dr D.S. Wratt (New Zealand).

Summing up the presentations made and discussions held in the four technical sessions, Prof. Das Gupta stressed the need to identify thrust areas for intensive global research in the nineties using acoustic sounding like sodar, sonar, RASS, minisodar and other complementary techniques like wind profiler, lidar, FM-CW radar, MST radar, satellite and other conventional techniques. He desired that the university contribution in the field, which is not much in India as well as in other countries, should increase. In the Indian context, he suggested to carry out extensive studies using acoustic sounding and other complimentary techniques, on air-sea interaction, antarctic atmosphere, urban air quality and pollution studies and on collaborative programmes like MONTBLEX. For the newly formed Indian Chapter of the Acoustic Remote Sensing Society, he suggested that it should organize well-planned workshops to involve and train young scientists in this comparatively simple, inexpensive but exciting field.

Recommendations

The following observations/recommendations were made:

1. Acoustic sounding is now a mature, well demonstrated technique and is considered today like any other conventional meteorological technique. The ability of sounders to

measure wind speed and direction profiles has been established beyond doubt and the use of technique to measure standard deviation of the vertical wind speed to a useful accuracy has been demonstrated. A knowledge of these parameters and information from the fascimile charts of echo strength about meteorological regime classification, inversion height and mixing height determination have been used in many boundary layer studies, microwave propagation and air pollution meteorology. In combination with UHF radars, sodar information can be used for monitoring applications near power plants as input to dispersion models.

2. Certain other boundary layer parameters (e.g. the temperature and wind velocity structure parameters, energy dissipation rate, sensible heat flux, energy spectrum, probability distribution function of vertical velocity) have been measured with sodar by research groups. Most of these measurements require careful interpretation, and for some there are theoretical limitations. Measurements of the standard deviations in the horizontal wind speed and direction are still controversial and have considerable uncertainty for theoretical reasons. Further work on quantifying the uncertainties in these methods by comparing the results from established measurement techniques may be useful.

3. Exciting developments have taken place in minisodar (high frequency sodar) design which are obviously very promising. Easily portable systems, which can be used in experimental mesoscale observing network, for field studies in complex terrain and for air pollution meteorology site studies, have been reported. Focus should now be on development and deployment of these relatively lowcost instruments. It is hoped that commercial firms will take up manufacture of such systems at the global level.

4. The resurgence of interest in RASS, resulting partly from the development of wind profiler radars with large antennae, is of major interest for synoptic meteorology/forecasting. Continuing development of such systems should be encouraged.

5. Sodar can make a major contribution to boundary layer studies like forest boundary layer, monsoon trough boundary layer, air-sea interaction and frost. However, acoustic sounding techniques alone cannot measure everything of interest, and users should be encouraged to use sodar as part of a complementary set of techniques, i.e. there should be a synergestic use of integrated systems. For example : RASS + UHF profiler + satellite radiometer data for synoptic studies + minisodar; Sounders both conventional and minisodar (if possible, several) + meteorological tower + tethered balloon for coastal internal bounday layer studies + ship-mounted sodar systems; Sounders (conventional and minisodar) plus balloon system plus tower(s) for air pollution meteorology studies. The coupling of such measurements with analytical, numerical and cognitive approaches to assimilate data makes a potent tool for understanding boundary layer processes and complex terrain flows.

6. Acoustic methods show promise for obtaining information on temperature and current patterns over large regions of ocean. Such information is of great importance for investigations of the global climate system and its variability (both natural and due to human activity). Continuing theoretical and experimental work to develop global approaches for environmental physical problems should be encouraged. This will evidently involve collection of large data sets, management of big experiments, processing schemes of raw data and analysis and interpretation of complex elaborate data.

7. Acoustic sounding methods, in combination with other measurement techniques, can be very useful in several parts of the upcoming International Geosphere Biosphere Programme (IGBP), e.g. ocean measurements, estimation of regional scale heat and momentum fluxes and their use in improving physical parameterization in global circulation models, and in air-sea interaction studies. Also, collaboration in national and international interdisciplinary experimental programmes forming part of IGBP should be encouraged.

8. Many meteorologists and environmental scientists are still unaware of the recent developments in acoustic sounding and related techniques, and further efforts to publicize the potential of such techniques and their expected measurement accuracy will be worthwhile. In this context, the extension of the scope of the next symposium at Athens, Greece, to include invited and contributed papers on other contemporary techniques used to study the atmosphere and oceans is a welcome sign. Of course, main emphasis should remain on field studies and instrumentation developments to measure more sophisticated parameters. For example, greater attention may be paid to develop multi-frequency Doppler sodar systems and combination of acoustic sounding systems with boundary layer radars.

9. For India and other developing countries, increasing use of sodars was recommended for urban air pollution studies (monitoring and prediction), environment impact studies, agricultural applications like micro climates for frost studies or forest boundary layer studies, monsoon trough boundary layer studies, observational programmes for IGBP and as an input for dispersion modelling.

10. To achieve the above, the existing state of art of development of sodar in the country be assessed in respect of performance, reliability, cost, etc.; emphasis be laid on the development of Doppler sodar, minisodar, RASS and profiling systems. A manufacturing agency be identified for collaborating with the development agency. A system of calibration be worked out with other techniques like kytoon, radiosonde, tower, etc and a complete data management plan including routine data

acquisition, handling, storage and dissemination be worked out so that data collected over different environments in India could be made available at one place. For carrying out these activities more dynamically, a national mission project be undertaken, funded and steered by a national committee.□

CSIR Programme on Global Change

Message from Dr A.P. Mitra, Director General, CSIR

Natural forces have influenced and shaped the environment of our planet over the course of its lifetime. The uniqueness and the challenges posed by the changes facing us today lie not only in the magnitude and rate at which these changes are occurring, but also in mankind's ability to effect these changes inadvertently.

The Council of Scientific and Industrial Research (CSIR), thanks to the multidisciplinary character of its 40 laboratories and its other infrastructural facilities including scientific and technical manpower and involvement with projects interfacing with those of International Geosphere Biosphere Programme, has a major role to play in studies on global change.

CSIR News is a good medium to disseminate information on the studies on Global Change undertaken in CSIR laboratories and other organizations in this country. However, with this first 'News Item', I wish that future developments and progress in Global Change studies in CSIR laboratories will enable us to bring out a separate CSIR News Letter devoted to the subject.

CSIR Steering Group on Global Change

There is a growing awareness, both at the international and national levels, of the necessity of preserving local, regional and global ecological balance. On a global level, the International Council of Scientific Unions (ICSU), the United Nations Environmental Programme (UNEP) and the World Meteorological Organisation (WMO) are seized of the environmental problems and are operating for solutions through their special committees. On a national level, other than CSIR, Department of Environment (DOEn), Department of Space (DOS), Indian National Science Academy (INSA), National Academy of Sciences of India and many other organizations have taken up environmental studies.

CSIR has constituted the following Steering Group for Global Change under the Chairmanship of Dr A.P. Mitra, Director General, CSIR, to identify, plan and lay down milestones and monitor the progress of projects and activities in this area:

Dr A.P. Mitra, DG, CSIR, (Chairman)

Dr R.A. Mashelkar, Director, NCL; Dr A.V. Rama Rao, Director, IICT; Dr P.K. Ray, Director, ITRC; Dr S.K. Joshi, Director, NPL; Dr P.V. Sane, Director, NBRI; Dr B.N. Desai, Director, NIO; Dr S. Banerjee, Director, NML; Dr R. Narasimha, Director, NAL; Dr A. Gopalakrishnan, Director, CMERI; Shri S. Singhal, Acting Director, IIP; Dr K.S. Yajnik, Head, CMMACS; and Dr K. Gopalan, Scientist, NGRI (Members).

Dr T.N. Khoshoo, Distinguished Scientist; Prof. R.R. Daniel, COSTED (Madras) and Prof. V.K. Gaur, Secretary, DOD (Permanent Invitees);

Dr B.S. Mathur, Science Secretary to DG, CSIR (Member-Secretary).

A Task Force consisting of a number of CSIR laboratories has been formed for each of the areas indicated below:

- Development of CFC Substitutes & Associated Equipment (*IICT*, NCL, ITRC, IIP, CMERI);
- Greenhouse Molecule Budgeting and Control (*NPL*, NEERI, NML, IIP, CMERI);
- Sea-level Monitoring and Modelling (*NIO*, NGRI, NPL);
- UV-B and Temperature Effects on Ecosystems, Aquatic Systems and Industrial Materials (*NBRI*, NIO, NCL, ITRC, NPL);
- Air-Sea Interaction (*NIO*, NAL, NPL);
- Earth System History (*NGRI*, NIO, NPL);
- Medical Effects and Related Aspects (*ITRC*, CDRI, NBRI);
- Mathematical Modelling (*CMMACS*, NAL NPL)

(The first-mentioned is the nodal laboratory).

Alternatives to Chlorofluorocarbons (CFCs)

CSIR has recently taken up studies on the development of Chlorofluorocarbon (CFC) substitutes. CFCs (R-11 and R-12) are the most commonly used refrigerants in the air-conditioning and refrigeration systems. These are important because on the one hand these are totally manmade, and on the other these are responsible for ozone depletion as well as global warming.

Depletion in ozone concentration will have deleterious effects on: human health (cancer, damage to eyes, loss of immunity); agriculture; aquatic ecosystems; material damage; tropospheric air quality; solar interactions, etc. Global warming, which will have its implications on global climate changes and global ocean circulation, will lead to: sea level rise and the melting of glaciers; changes in wind and ocean currents; changes in precipitation and water resources; changes in frequency of extreme events; impact on agriculture, etc.

R-22 with a lower Ozone Depleting Potential (ODP) has been developed as a 'Drop-in' alternative. However, the properties of R-22, particularly vapour pressure, miscibility with lubricants and the performance of a system designed for R-11 or R-12 but operating on R-22, vary significantly. NCL is studying the required modifi-

cations of the existing sytems to suit R-22 (R-11, R-12 and R-22 are being manufactured in India).

The possible alternatives which have been identified with no or minimum harmful effects are R-134$_a$ for R-12 and R-123 for R-11. While IICT is working on the development of these chemicals, there is as yet no programme to look for alternatives from a wider perspective with respect to tropical conditions and applications to: (1) Refrigeration, Air-conditioning and Heat Pumps; (2) Rigid and Flexible Foams; (3) Electronics, Degreasing and Dry-cleaning; (4) Aerosols, Sterilants and Miscellaneous Use and (5) Halon Fire Extinguishing Agents. Based on the existing thermodynamic and transport data of known chemicals, NCL is conducting computer-aided screening to synthesize, through computer simulation, chemicals with desired properties but with no or minimum ozone depletion or global warming. These chemicals, again through computer simulation, will be tested with the existing systems, or with these systems under altered conditions or systems with a conceptual design. It is expected that through this process one will arrive at the real systems and achieve the desired objectives.

Development of lubricating oils for the refrigerating machinery using CFC substitutes will be carried out by IIP, the toxicological evaluation of CFC substitutes by ITRC and the experimental assessment of appliances using CFC substitutes by CMERI. R-22, because of its easy availability, will be tried as the first CFC substitute in these studies. □

NPL's Aeronomy Payloads for SROSS Satellite

The National Physical Laboratory (NPL), New Delhi, has been engaged in the area of space research using rockets and balloons for more than two decades and has conducted a large number of experiments for exploring the earth's ionosphere and middle atmosphere. NPL has now been chosen as one of the laboratories to provide aeronomy payloads on the first Indian Aeronomy Satellite of SROSS series being developed by the Indian Space Research Organisation (ISRO).

NPL is developing payloads of Retarding Potential Analyzer (RPA) and Energetic Particle Spectrometer (EPS), to be flown on SROSS-3 Satellite of 150 kg class which was initially planned to be launched in 1989-90. However, the ISRO has decided to launch first a simpler satellite of lesser weight (100 kg) and simpler configuration, before launching SROSS-3. The simpler satellite named as SROSS-C, with the following configuration and orbital parameters, is scheduled to be launched in early 1991:

Weight	:	100 kg
Shape	:	octagonal prismoid with 8 body mounted solar panels
Size	:	1100 mm height × 700 mm A/F size of octagon
Spin rate	:	2-5 rpm
Spin axis	:	parallel to one of the lateral axes and perpendicular to orbital plane
Orbit inclination	:	46°
Orbit	:	400-550km (near circular)
Lifetime	:	one year (approx.)
Power	:	36 W

This satellite will spin in a cartwheel mode. Longitudinal axis of the satellite is planned to rotate in its orbital plane with the spin axis perpendicular to the orbital plane. The top deck of the satellite will see positive roll axis once in each spin rotation of the satellite.

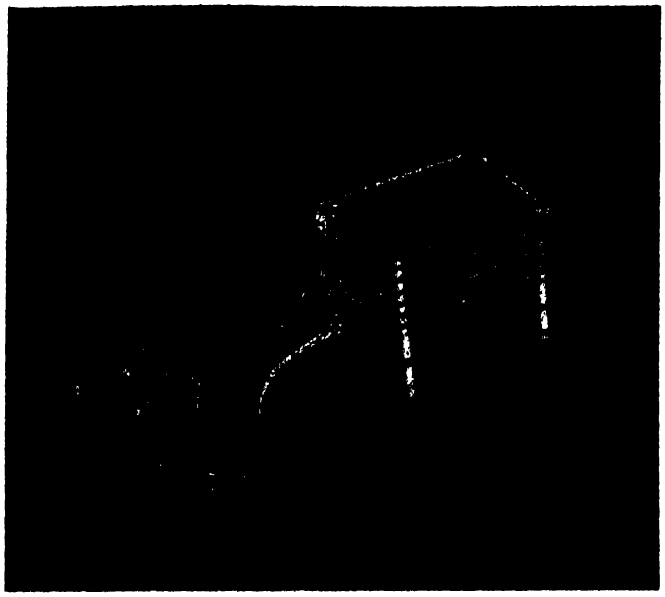
Out of the two SROSS-3 payloads from NPL, the RPA payload has been selected for SROSS-C mission as the SROSS-C configuration is more suitable for this experiment. The other payload on the mission is the Gamma Ray Burst payload of the ISRO Satellite Applications Centre (ISAC), Bangalore.

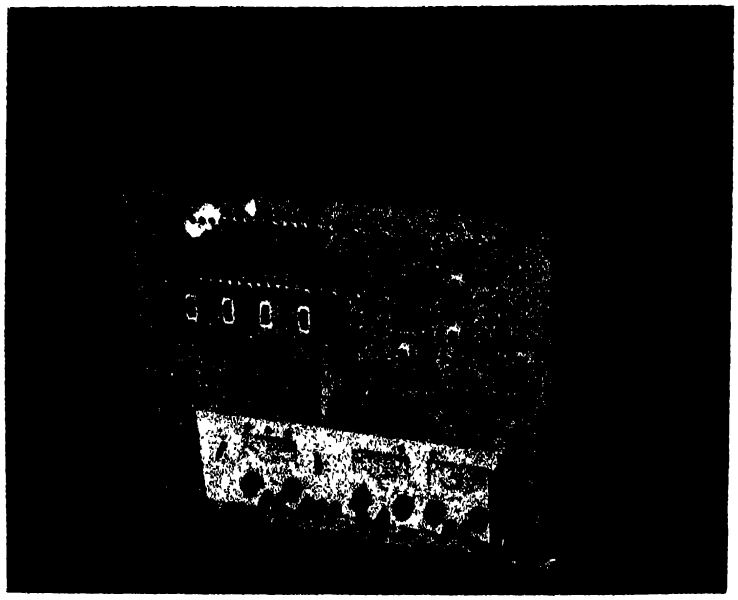
The RPA payload on SROSS-C will measure ionospheric electron as well as ion parameters using two independent RPA sensors. Both the sensors would be mounted on the top deck of the satellite, having their axes perpendicular to the deck plane and looking outward. Thus, with the spinning of the satellite, both the sensors will see the satellite velocity vector once in every spin. The ion RPA will make useful measurements during ±30° and electron RPA during ±90° angle of attack of sensors with respect to the satellite velocity vector.

The main objective of this experiment on SROSS-C is to study the ionosphere and thermosphere of low latitudes. It will measure all the essential parameters like electron and ion densities and temperatures to characterize the ionosphere and its thermal state. It will also measure the major heat input parameter, the suprathermal electrons.

The RPA payload consists of two sensors and one electronics box. The sensors are multigrided Faraday Cups and work on the principle of a pentode vacuum tube. The associated electronics measure the pico-amp currents drawn by the sensors from space corresponding to different retarding voltage-biases applied on various grids of the sensors. The system is designed to be operated through ground tele-command in various modes for measuring the parameters of interest under different ionospheric conditions. A microprocessor based system processes and formats the payload data and finally outputs it in a digital serial stream. Redundancy in the payload is provided wherever necessary.

The work on RPA payload fabrication along with its qualification to space standards is being carried out at the Radio Science Division of NPL and ISAC, Bangalore. Two other CSIR laboratories, CEERI-Pilani and NAL-Bangalore, are extending help



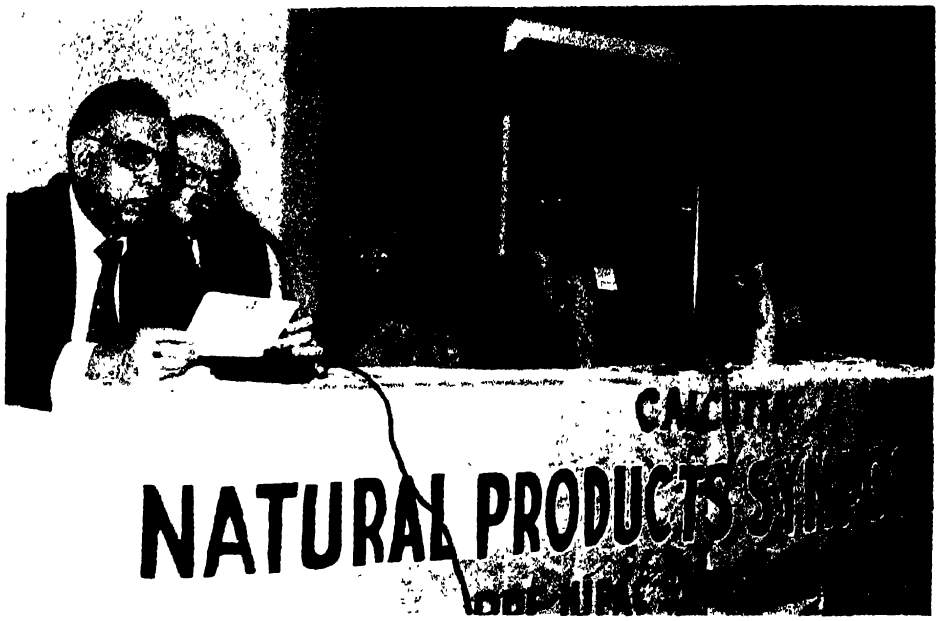


RPA payload electronics and Ground check out system

to NPL in this project. CEERI is developing electron and ion sources for calibrating the RPA sensors and NAL is doing gold plating on the RPA sensors to meet stringent requirements for space qualification. □

IUPAC Pre-Symposium on Natural Products

A pre-symposium of the International Union of Pure & Applied Chemistry (IUPAC) Symposium 17 was organized by the Indian Institute of Chemical Biology, Calcutta, during 31 January-2 February 1990 under the cosponsorship of the Indian Association for the Cultivation of Science, Indian National Science Academy and the Council of Scientific & Industrial Research.



Dr S.C. Pakrashi, the then Director of IICB, Calcutta, delivering the inaugural at the Pre-IUPAC Symposium on Natural Products. Seen on the dais (*from left*) are: Prof. J. Meinwald, Cornell University, Ithaca, New York, USA; Prof. (Smt) Asima Chatterjee Calcutta University; Dr R.V. Venkateswaran, IACS, Calcutta; and Dr S.B. Mahato, IICB

Eleven overseas delegates from Australia, France, Japan, Korea, Sweden, Switzerland, USA and USSR, participated in the meeting and presented papers covering a wide range of topics on modern trends and directions in research on natural products, under two different categories, viz. plenary and sectional. Nine posters were also presented during the sessions. In all six plenary lectures and sixteen sectional lectures were delivered by scientists from different Indian universities/institutes, and those from abroad.

The meeting was attended by 125 general delegates.

* * *

CSIR celebrates National Science Day

The National Science Day, celebrated on 28 February every year, marks the anniversary of the discovery of the 'Raman effect' by Sir C.V. Raman who won Nobel Prize in 1930. The CSIR laboratories/institutes celebrate this day by arranging lectures by emi-

nent scientists/technologists, observing 'Open Days', holding exhibitions and video/film shows on R&D activities/ achievements. As in the previous years, this year also a large number of school/college students and others visited the CSIR establishments, on this occasion.

At a function organized by the National Council for Science & Technology Communication, Prime Minister Shri V.P. Singh addressed a galaxy of scientists, and gave away NCSTC awards for science popularization, and the Department of Biotechnology awards. He also released two special publications brought out by CSIR (PID): (i) *CSIR-Catalyst in National Development* and (ii) *Readings from Science Reporter & Vigyan Pragati*. This function was also addressed by Prof. M.G.K. Menon, Minister of State for Science & Technology and Vice President, CSIR; Dr Vasant Gowariker, Secretary, Department of Science and Technology and Dr A.P. Mitra, Secretary, Department of Scientific & Industrial Research and Director General, CSIR. □

CAD Centre of IICT develops New Software for designing of Commercial Plants

The Indian Institute of Chemical Technology (IICT), Hyderabad, has been offering technologies along with design and engineering services for the commercial plants set up by the private and public sector undertakings. Apart from preparing the standard documents like engineering flow diagrams, equipment design and specifications, plant and process piping layout, etc., IICT is also developing designs for complex non-standard equipment which have to be specially fabricated for the plants. The Design and Engineering Division of IICT, which has been doing this job competently over the years, established a Computer-aided Design (CAD) Centre, a few years back, to increase its efficiency. The Centre has developed the following new software which will prove extremely useful in the designing of commercial plants:

Computer system at the CAD Centre of IICT, Hyderabad

rnf—This program has been developed for the design of reinforcement of openings in pressure vessels, as per the procedure given in ASME Section VIII, Division 1. It can design for fifteen different types of nozzle attachments.

fxts designs fixed tubesheets for a shell and tube heat exchanger as per the code of TEMA.

extpr has been developed for the design of pressure vessels subjected to external pressure, following the code given by ASME Section VIII, Division I. It can design for fifteen different ferrous materials.

intpr designs pressure vessels subjected to internal pressure as per the design code of ASME Section VIII, Division 1 It also calculates the empty and water-filled weight of the vessel, and can design vessels for sixteen different ferrous materials of construction.

prdrop calculates the pressure drop in pipelines with single phase flow; fifteen types of fittings and components have been considered.

bsfrp designs pressure vessels made of fibre reinforced plastics subjected to internal pressure. It follows the procedure suggested by BS 4994/1973.

Interested organizations/individuals may contact Shri T. Krishna Reddy, Head, PCL Division, Indian Institute of Chemical Technology, Hyderabad 500007, for further details.

Characterization of Chloroplast DNA from *Populus deltoides*

The photosynthetic characteristics of certain tree leaves have shown that the choloroplast function adapts itself to changing environmental conditions during different seasons of an year; for example a substantial shift in the temperature optimum for photosynthesis and resistance to inactivation by high temperature and high light

intensity during summer are seen in poplar. Biochemical mechanisms leading to such resistance have already been under investigation at the National Botanical Research Institute (NBRI), Lucknow. But the gene action responsible for enabling the plant to adapt itself is also important. Nuclear genome has been extensively utilized for transference of characters by genetic crosses or otherwise, through recombinant DNA techniques. However, chloroplast genome, which is equally important, has not been made use of very well for this purpose. With the objective of tapping the potential of improving tree productivity through gene manipulation of the chloroplast, investigations of genome of tree chloroplast have also been taken up at the institute. *Populus deltoides* (poplar), which is a commercially important and a suitable species for agroforestry in the Indo-gangetic plain, has been selected with a view to isolating chloroplast DNA (cpDNA), finding out its characteristics and constructing a restriction map for further investigations.

Young leaves of clone D-121 of *P. deltoides*, which is being cultivated at the Banthra Research Station, were harvested and kept overnight in the dark for destarching. Intact chloroplasts, prepared by slight modification of the routine procedure, were treated with DNase-1 to get rid of any extra-chloroplast DNA present in the preparation. Chloroplasts were repeatedly washed with 0.6M buffered sucrose containing EDTA and then chloroplast DNA was isolated and purified on CsCl gradient, using SW 50.1 rotor and L-8 70M Beckman ultra-centrifuge. The cpDNA band was located under ultraviolet light (340nm) in the presence of fluorescent dye (ethidium bromide), removed and precipitated. The DNA pellet was redissolved either in autoclaved distilled water or TE buffer for further analysis.

The isolated cpDNA moved as a single band when electrophoresed on 0.8% agarose slab gel, indicating its singular physical form, probably closed circles, similar to other plant species. The DNA was subjected to different endonuclease digestions, viz. Ava 1, Eco R1, Hind 111, Kpn 1, Nru 1, Sal I and Xho 1, which recognize specific nucleotide sequences for restriction, in order to calculate its molecular size. The Hind 111 digest of lambda DNA was run parallel as a size marker. Preliminary data showed that the genome size of *Populus* chloroplast might range anywhere between 80 and 90 Kbp. This size of *Populus* cpDNA appears small but could be characteristic of some tree chloroplasts as observed in a few other cases also. The deletions in the region of inverted repeats have been shown in the case of *Pinus contorta* and *P. banksiana*, which result in a small size of cpDNA. In *Populus* chloroplasts also, this may be true and the extent of deletions, if any, will be established through probing in subsequent analysis. The strategy planned for the construction of restriction map is bidirectional. One is to restrict the DNA with that endonuclease which gives bigger sized fragments. These fragments are eluted individually from preparative gel, purified and subjected to further restriction with another enzyme which cuts at more places as compared to the first one. The process is repeated and subfragmentation continues with different enzymes. Computation of overlaps, appearance and disappearance of fragments of particular size, etc. give an idea as to how the DNA might have arranged actually in the chloroplast genome. The second is to clone various fragments of the DNA, produced by an endonuclease which gives, a reasonable number of fragments, into a cloning vector (shot gun cloning). Different clones are again subjected to either further restriction, used as probes or its subfragments probed. Data are computed as in the first case and restriction maps constructed. The first approach has been made use of at the institute to construct a restriction map of cpDNA of *Populus*. □

NEW PUBLICATIONS

Groundnut and *Indian Brassicas*

The Publications & Information Directorate (PID), New Delhi, has brought out two publications, viz. *Groundnut* and *Indian Brassicas*. The text matter for these publications has been drawn from volumes 1A and 2B, respectively, of the revised series of *The Wealth of India : Raw Materials*. They contain detailed information regarding origin, distribution, breeding, important cultivars, cultivation practices, area and production, diseases and pests, chemical composition and utilization, and trade data on the crops and their products. They also contain list of references and a general index, to facilitate the reader. These publications will prove useful and handy to readers particularly interested in these crops, as well as to the edible oil industry.

Copies of the publication (price Rs 45 and Rs 50, respectively) can be had from: The Sales & Distribution Officer, PID, Hillside Road, New Delhi 110012. □

Software Packages for Structural Analysis, Design and Drafting

The Structural Engineering Research Centre (SERC), Madras, has been developing computer software for structural analysis, design, and optimization since the last several years. As part of this work, it has developed special purpose application-oriented programs for structures and structural elements such as frames, grids, shells, columns, beams, and slabs. Written in user-friendly inter-active mode, these programs enable the designers to solve their design problems using even small computers which are now available with many design offices and consultants in the country. The demand for these programmes has been quite encouraging and several

designers have procured them in the last few years.

SERC, Madras, has brought out a booklet which lists all the salient features of these 13 programs, including terms for licensing. These programs are: 1. INFRAN (INteractive FRame ANalysis), 2. INGRID (INteractive GRID analysis), 3. INSPACE (INteractive SPACE frame analysis), 4. INTRAN (INteractive TRuss ANalysis), 5. INCYSHELL (INteractive CYlindrical SHELL analysis), 6. INFOLD (INteractive FOLDed plate analysis), 7. RC SLABS (Reinforced Concrete SLABS design), 8. RC BEAMS (Reinforced Concrete BEAMS design), 9. R.C COLUMNS (Reinforced Concrete COLUMNS design), RC FOOTING (Reinforced Concrete isolated FOOTINGS design), 11. RC COMBINED FOOTINGS (Reinforced Concrete COMBINED FOOTINGS design), 12. RC FLAT SLABS (Reinforced Concrete FLAT SLABS design), and 13. MICSTRAN (MICrocomputer STRuctural ANalysis).

The booklet (pp. 26) can be had from: The Director, SERC, Madras 600113. □

Administrative Training Programme

A Training Programme for Assistants (Gen) of CSIR was held during 12-16 February 1990 at CSIR Vigyan Kendra, New Delhi. Dr M.P. Dhir, Director (Engineering Coordinator), CSIR, inaugurated the programme and Shri Omesh Saigal, Joint Secretary (Admn.), CSIR, delivered a keynote address on 'Administration of Science' □

Retirements

Shri K. Subramanian

Shri K. Subramanian, Internal Financial Adviser, CSIR, has relinquished charge of the post with effect from 28 February 1990 (AN), consequent upon attaining the age of superannuation. □

Prof. H.S. Ray takes over as Director, RRL-Bhubaneswar

Prof. H.S. Ray, an eminent scientist and educationist, has taken over as Director, Regional Research Laboratory (RRL), Bhubaneswar, on 1 March 1990.

Prior to his present assignment, Prof. Ray was a Professor in the Department of Metallurgy, Indian Institute of Technology, Kharagpur, (since 1980). Prof. Ray had his early education in Bhagalpur, Bihar. He stood second in I.Sc. examination of the Bihar University. After obtaining B. Tech. (Hons) in Metallurgical Engineering from IIT-Kharagpur in 1962, M. Tech. and Ph.D. degrees from the University of Toranto, Canada, in the years 1963 and 1966, respectively, Prof. Ray joined IIT-Kanpur in 1967. He also worked as a Visiting Associate at the University of Toranto during 1974-76 and worked at the R&D Laboratory of Pilkington Brothers, Lathom, UK, during 1977-79. He has guided 10 Ph.D. and 21 M. Tech. students and published around 220 articles including research papers, popular science articles and research reports and presented more than 130 research papers in various conferences in India and abroad. He has written several books which are recognized internationally. Prof. Ray is a consultant for RDCIS of the Steel Authority of India Limited (SAIL). His main areas of interest are extractive metallurgy, fused salt chemistry, glass melting and reaction kinetics. As a distinguished metallurgist, Prof. Ray has been associated with many learned science academies, professional organizations and societies. □

Honours & Awards

Dr T.N.B. Kaimal

Dr T.N.B. Kaimal, Scientist E, Oils and Fats Division, Indian Institute of Chemical Technology (IICT), Hyderabad, has been awarded 'Dr S. Husain Zaheer Award— 1989' by the Oil Technologists' Association of India (OTAI), for his excellent work on chemical modification of porcine pancreatic lipase and lipase catalyzed interesterification reactions for the production of low linolenic acid-containing products without *trans*-isomers from soybean oil. The work has considerable conceptual significance for the development of biotechnological process.

The award carries a cash prize of Rs 5000 and was instituted in 1979 by the Zaheer Science Foundation, New Delhi, for his excellence in research contribution to oil chemistry and technology, surface coatings and allied subjects through research papers, published during the previous three calendar years. □

ANNOUNCEMENTS

WHO-ITRC Training Workshop on Environmental Epidemiology

A WHO-sponsored Training Workshop on Environmental Epidemiology is being organized at the Industrial Toxicology Research Centre, Lucknow, in the second week of May 1990. The aim of the workshop is to train persons working in the field of environmental pollution and its effects on human health, in techniques of Environmental Epidemiology. The participants will be expected to use this training in course of their routine activities and to train their subordinates for detection of morbidity related to environmental cause.

Further details regarding the workshop may be had from: Prof. (Dr) B.N. Gupta, Assistant Director & Scientist Incharge, Epidemiology Division, Industrial Toxicology Research Centre, Post Box No. 80, Mahatma Gandhi Marg, Lucknow 226001. □

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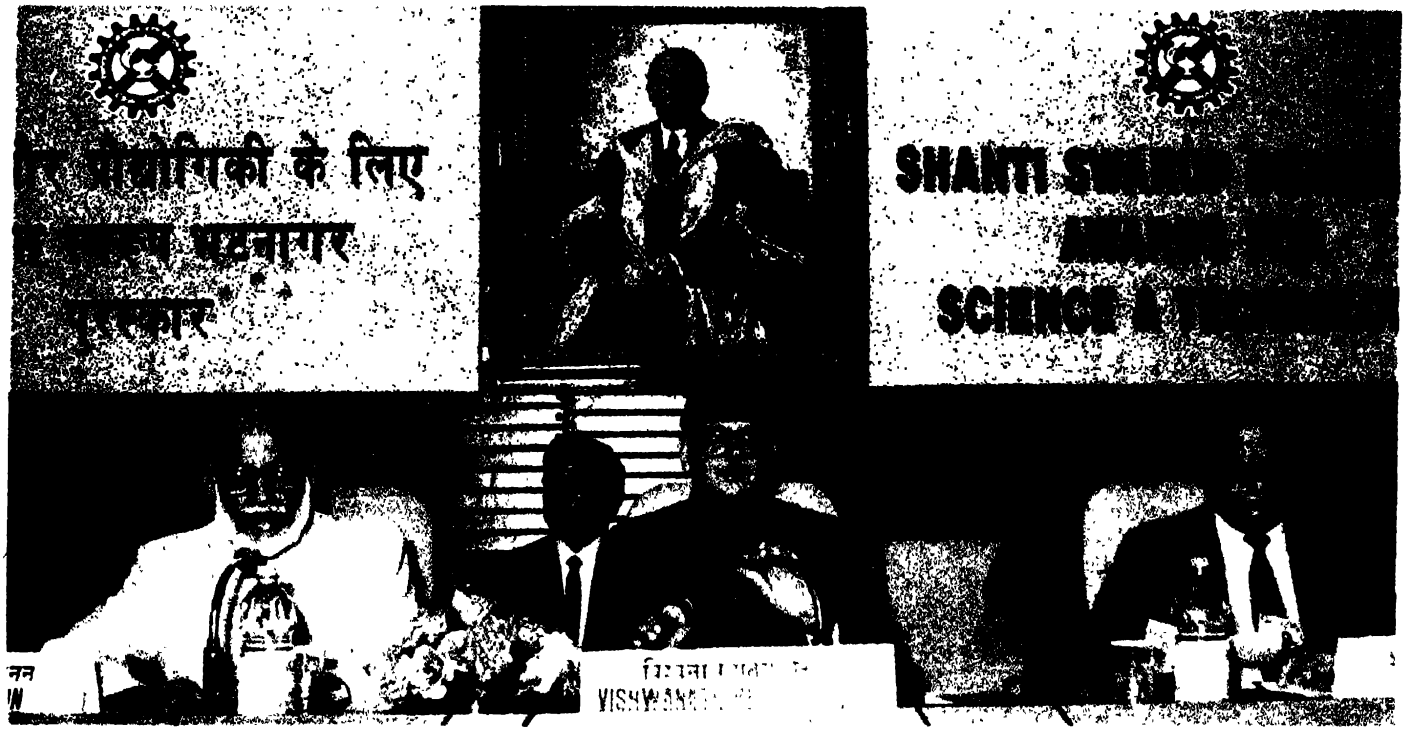

The Prime Minister Shri Vishwanath Pratap Singh gave away the Shanti Swarup Bhatnagar Prizes (1988) to ten distinguished scientists, at a function held in New Delhi (p. 86). Here he is seen addressing the gathering on the occasion. To his right is Prof. M.G.K. Menon, Minister of State for Science & Technology and Vice President, CSIR, and to his left, Dr A.P. Mitra, Director General, CSIR

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Shanti Swarup Bhatnagar Prizes for 1988 presented

Ten scientists were awarded the Shanti Swarup Bhatnagar Prizes for 1988, at a function held in Vigyan Bhavan, New Delhi, on 28 March 1990. The Prime Minister, Shri Vishwanath Pratap Singh, who is also President of CSIR, gave away the prizes.

Speaking on the occasion Shri V.P. Singh said, "I have no doubt that science and technology has a very vital role to play in social and economic transformation of society. We fully recognize that science and technology is an important input in development programmes which we have launched. There is quite a lot of expectation on our part from the national laboratories and research institutions, in which a large number of scientists and technologists are working."

"In a number of areas science has made visible impact in our country. Achievements of Indian scientists are quite remarkable in the fields of atomic energy, space, chemicals, fertilizers, communicable diseases and computer software." "Recently", Shri Singh said, "the technology missions have depended considerably on the transfer of technology from the laboratories".

"The scientists constitute an important link in the chain of various groups of professionals who should together turn scientific and technological findings into useful programmes for the community. We should have effective mechanisms to produce results and ensure that they are used in the spheres in which we want improvement to take place. This is a task in which several agencies are required to work in unison. I do hope that scientists will continue to do science with the focus on getting solutions which have practical applications—solutions that are applicable under our conditions." "We need a total approach for applying science and technology to development. This should be viewed as some sort of a relay race in which the scientists pass the baton to the next group of people engaged in the work of development".

Shri V.P. Singh, Prof. M.G.K. Menon and Dr A.P. Mitra with the Shanti Swarup Bhatnagar Prize-winners

Right now, Shri Singh said, we are in the process of reorienting plans to ensure balanced development of the country with emphasis on improving the lot of the poor. These plans include priority areas such as land reforms, natural resources, water management, education, health, population control, wasteland development and lowcost housing. With several research programmes in these areas under way in national laboratories, the Prime Minister hoped that our scientists would find solutions to the many intricate problems in these areas before long.

Shri Singh said that the late Sir Shanti Swarup Bhatnagar was one of our distinguished scientists who played a prominent role in the establishment of the national laboratories. It is, therefore, only appropriate that his name should be associated with one of the most prestigious prizes for human endeavour.

Earlier, the Minister of State for Science & Technology and Vice President of CSIR, Prof. M.G.K. Menon in his welcome address said that many CSIR programmes were of direct relevance to the society. He suggested that the scope of science and technology should be expanded to cover products and services also.

Dr A.P. Mitra, Director General, CSIR, read out the citations of the awardees [See *CSIR News* 39 (1989), 250 & 40 (1990), 8 for citations]. The awardees are:

Biological Sciences: Dr B. Bhattacharyya, Department of Biochemistry, Bose Institute, Calcutta and Prof. M.R.S. Rao, Department of Biochemistry, Indian Institute of Science, Bangalore.

Chemical Sciences: Prof. K. Kishore, Department of Inorganic & Physical Chemistry, Indian Institute of Science, Bangalore.

Earth Sciences: Dr S.K. Tandon, Department of Geology, University of Delhi, Delhi.

Engineering Sciences: Prof. B.D. Kulkarni, Chemical Engineering Division, National Chemical Laboratory, Pune and Prof. S. Prasad, Department of Electrical Engineeing, Indian Institute of Technology, New Delhi.

Library

Mathematical Sciences: Prof. M.B. Banerjee, Department of Mathematics, Himachal Pradesh University Shimla and Prof. K.B. Sinha, Mathematics Statistics Division, Indian Statistical Institute, New Delhi.

Physical Sciences: Prof. D. Kumar, School of Physical Sciences, Jawaharlal Nehru University, New Delhi and Prof. O.N. Srivastava, Department of Physics, Banaras Hindu University, Varanasi. □

Bhatnagar Laureates' Get-together

The Shanti Swarup Bhatnagar Prize, instituted in 1957 by the Council of Scientific & Industrial Research in the memory of its founder architect and first Director General Sir Shanti Swarup Bhatnagar, is today the country's most prestigious Science and Technology award. The recognition it confers is considered a matter of pride by the most distinguished among the Indian Scientists and Technologists.

The prize is given in recognition of outstanding contributions in Science and Technology, made primarily in India, during the five years preceding the year of award. To encourage young scientists and technologists, persons who are below 45 years of age alone are considered. The fields for which the prize is given are: Biological, Chemical, Mathematical, Engineering, Medical and Earth Sciences. The prize at present carries a citation, a plaque and Rs 50,000 in cash. Till to date 227 distinguished scientists/technologists have won this award.

A get-together of the Bhatnagar laureates was organized by CSIR in New Delhi, on 4&5 April 1990, in which 154 of the 227 Bhatnagar laureates participated.

The Bhatnagar laureates used the occasion to exchange their experiences and views which could help in the 'furtherance of excellence in S&T'. In addition, some 15 laureates delivered invited lectures not only on the present and future of S&T in India but also on their own fields of research. Mementoes were presented to the laureates by Prof. M.G.K. Menon, Minister of State for Science & Technology and Vice President, CSIR.

Addressing this assembly of scientific glittereti, Prof. Menon, who is himself a Bhatnagar laureate, said: "The Bhatnagar Prize is now regarded as a stamp of excellence not only by the scientific community but by a whole cross-section of the Indian public." He further emphasized that the prizes are highly objective and above controversy, and congratulated CSIR in selecting the most suitable awardees from a wide spectrum of S&T workers.

Speaking on the promotion of excellence in S&T, Prof. C.N.R. Rao, Director, Indian Institute of Science, Bangalore, recalled the time when small CSIR grants helped in starting the careers of many a young researchers. However, he reiterated that although apparently grants are given to individuals, it is really science which becomes a gainer.

Lamenting over the comparatively smaller number of excellent young scientists that are coming up these days, Prof. Rao said that perhaps it is the senior scientists who are to be blamed for this. Many good young scientists, he observed, are not "at ease with their seniors." A sense of

Prof. C.N.R. Rao, Director, Indian Institute of Science, Bangalore, delivering his address: Promotion of Excellence in S&T, at the Bhatnagar Laureates' Get-together

coexistence and compromise, he felt, should be there besides competitiveness. India, he said should produce more and more excellent scientists. For, "excellence thrives only when there is a lot of excellence."

Prof. Rao also presented his work relating to spectroscopy and superconductivity.

Dr S.C. Bhattacharya of the National Chemical Laboratory, Pune, in his address remarked, "Unfortunately, the really talented students these days are going in for more lucrative fields like engineering and management instead of pure science."

Talking about the status of S&T in India, Dr S.S. Guraya, Head, Department of Zoology, Punjab Agricultural University, Ludhiana, ascribed the overall mediocre quality of Indian science to a lack of motivation among young people and the lure of more lucrative and easy jobs. He also blamed layer upon layer of bureaucratic red-tapism' in our scientific institutions,' which prevents brilliant young scientists from coming up with their best. "Science managers", he said, "have very little interaction with young scientists which has a demoralising effect on the latter." Gerontocracy, he added, is another factor which comes in the way of aspiring, talented young scientists. It robs them of opportunity, autonomy and the freedom to select their own research problems.

Speaking on 'brain drain from India', Prof. S.P. Sukhatme, Department of Mechanical Engineering, IIT, Bombay, pointed out that a substantial number of 'scientists' who migrate to the West are really no more than trained technicians. There are at most about 200 really talented young scientists about whom the country should worry about. More often than not it is a permanent loss. This is the real brain drain. He strongly felt that a concerted effort should be made to get these scientists back: "Even if we succeed in bringing one out of three back, i.e. 70-80, we should be satisfied as all of them could be potential Bhatnagar Prize winners."

Expressing a different view, Prof. C.N.R. Rao said that out of the 200 talented scientists Dr Sukhatme referred to, only a few get really top positions in the country of their adoption, while most of them end up as middle level scientists.

The Bhatnagar laureates who presented their work included: Prof. B.K. Bachhawat, Head, Department of Biochemistry, Delhi University (South Campus), New Delhi; Dr A.N. Mitra, Department of Physics & Astrophysics, Delhi University, Delhi; Prof. M.M. Sharma, Department of Chemical Technology, University of Bombay, Bombay; Prof. Obaid Siddique, Senior Professor of Molecular Biology, Tata Institute of Fundamental Research, Bombay; Dr S.K. Tandon, Department of Geology, University of Delhi, Delhi and Dr Indira Nath, Department of Pathology, All India Institute of Medical Sciences, New Delhi.

Winding up the get-together, Dr A.P. Mitra, Director General, CSIR, announced a few projects to be taken up to involve more young scientists in national scientific missions, e.g. the GMRT (Giant Metrewave Radio Telescope) and the International Geosphere Biosphere Programme. He informed that a database on S&T workers already exists in CSIR. A more detailed database would be built up for the talented people of different age groups and also for the Indians working abroad. He also announced that the get-together of Bhatnagar laureates would be held again after five years.

□

Prime Minister addresses CSIR Directors' Conference

The Prime Minister Shri Vishwanath Pratap Singh, who is also President of the Council of Scientific & Industrial Research (CSIR), addressed the CSIR Directors' Conference held at Vigyan Bhavan, New Delhi, on 28 March 1990. The text of the address is presented here:

Prof. Menon, Dr Mitra, Ladies & Gentlemen:

I am indeed happy to attend this Conference of the Directors of CSIR laboratories. With a network of 40 research laboratories and around 100 extension centres and field stations, CSIR is our premier R&D organization, of which the country can be proud. Over a period of time, the Council has built a vast reservoir of scientific talent and nurtured a vast infrastructure for research and development.

It is therefore quite natural that the country would expect CSIR to contribute to the national development in a greater measure. We are looking to the scientific community, particularly the CSIR, to come up with new breakthroughs in our fight against poverty and backwardness. I am happy to note that the Council has further sharpened its focus and has been designated as the nodal agency for some of the programmes identified under the S&T Action Plan.

It is my hope that your efforts in this direction would become a model worthy of emulation by other scientific organizations.

One can hardly over-emphasize the need for integrating the network of CSIR laboratories with the whole economic and industrial activity in the country. Research and innovation have to play a very major role in industrialization today. There are many sectors in which the technological development has not kept place with the needs of the economy. CSIR has a major responsibility for indigenous technological development with provision for continuous upgradation.

Even when technology has to be imported, it is necessary to see that it is properly absorbed and adapted and that it leads to innovation. I learn that the industrial output from CSIR-based technologies is quite significant. While this is encouraging, still more needs to be done. More effective steps need to be taken for ensuring a better interaction between CSIR and the industrial sector.

CSIR has to be at the forefront of the international science & technology in at least a few selected areas. These areas could be those in which we as a nation have a competitive advantage or where technology would be denied to us for commercial or political reasons. I understand that in areas such as petrochemicals, catalysts and drugs, CSIR is making significant strides. I was also pleased to learn that CSIR is exporting technologies to even the developed countries in some of these areas.

CSIR today has a very large complement of scientific and technical talent covering a very broad spectrum of disciplines. It is the quality of persons in the CSIR that would ultimately determine its output and work. I am happy to note that CSIR has realized the need for recognizing and nurturing excellence both inhouse and external. The introduction of Bhatnagar Fellowships for eminent and outstanding scientists in the country and Distinguished Fellows Award for inhouse scientists are steps in this direction. I hope that these efforts to recognize and reward merit will encourage creativity and excellence in the Council.

Although we have a very sizeable S&T manpower, only a small percentage of it is actually deployed for research and development purposes. If we are to take our rightful place in the comity of nations, it would be necessary that the manpower on R&D is not only enhanced but it is deployed in the right areas as well. In the years to come, CSIR will have to devote its efforts to generate the right R&D manpower not only for itself but also the other R&D organizations in the country.

I hope that this Conference of the Directors of CSIR would seriously deliberate on how the Council can serve the nation—still better. I wish you all success. □

Silver Jubilee Celebrations at ITRC

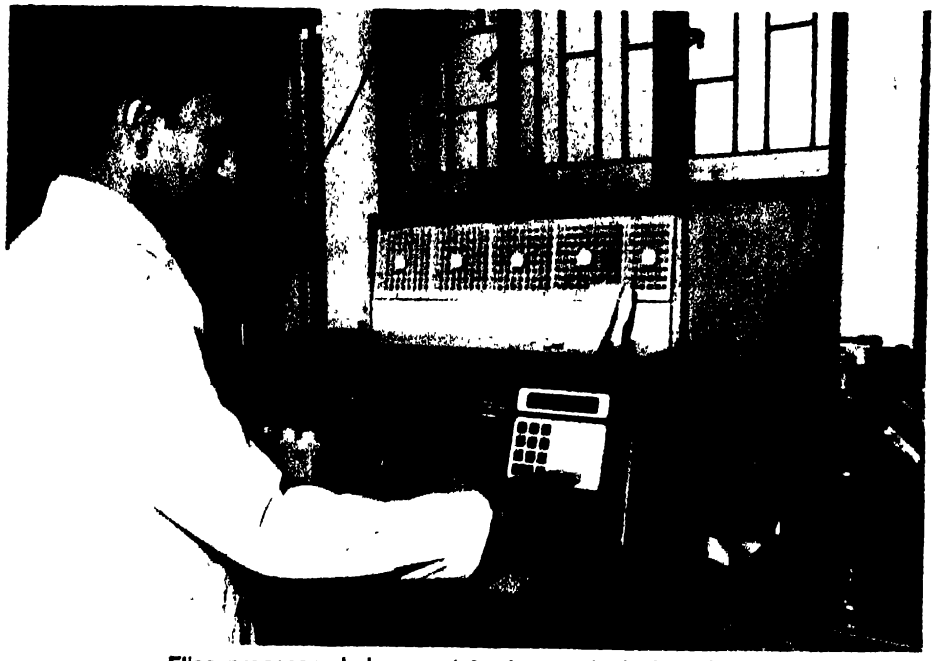
The Industrial Toxicology Research Centre (ITRC), Lucknow, established in 1965, completed 25 years of its existence in 1989. The Centre is observing November 1989-October 1990 as the Silver Jubilee Year. Over the years, ITRC has developed, gradually but systematically, R&D capabilities in all the modern areas of Toxicology, incorporating the necessary multidisciplinary expertise and sophisticated technical facilities. In addition to the regulatory requisites of safety evaluation, facilities have been created in specialized areas such as mutagenicity, teratogenicity, carcinogenicity, neurobehavioural, cardiovascular, developmental and immunotoxicity. Concerted efforts have been made to develop facilities for inhalation, phyto-, photo-, eco-, and aquatic toxicologies. Mechanistic studies on toxicity at cellular, organelle and molecular levels are being carried out using systems like cell lines, membranes, macrophages and macromolecules. Though the thrust of R&D efforts of ITRC is directed towards studying the toxicity of heavy metals, pesticides, hydrocarbons, plastics and polymers, a wide variety of other toxicants such as food contaminants, detergents, dusts and fibres are also being studied for their toxicity, mechanism of action and preventive measures. Studies on risk assessment and control through environmental monitoring and epidemiology are also undertaken at important industrial locations.

The research efforts of the 28 specialized sections have been recently grouped under five broad areas (Environmental Health, Systemic Toxicology, Preventive Toxicology, Ecotoxicology and Pesticide Toxicology) to encourage collaborative programmes in addition to meeting the specific sectional research interests and for better coordination and utilization of resources. At present, about 100 scientists trained in various disciplines such as Biochemistry, Molecular Biology, Immunology, Chemistry, Microbiology, Pharmacology, Pathology, Zoology, Botany, Mathematics are working in the Centre, backed up by internationally comparable sophisticated instrumentation and databases. All these capabilities and accomplishments in the field of occupational and environmental toxicology have helped ITRC acquire a high level of credibility in the national and international scientific arena. In the past 24 years, the progress in R&D at ITRC has been in conformity with such activities going on elsewhere, both in quality and quantity. Over 1000 original publications from ITRC have appeared in reputed international journals, which have been highly acclaimed and widely cited.

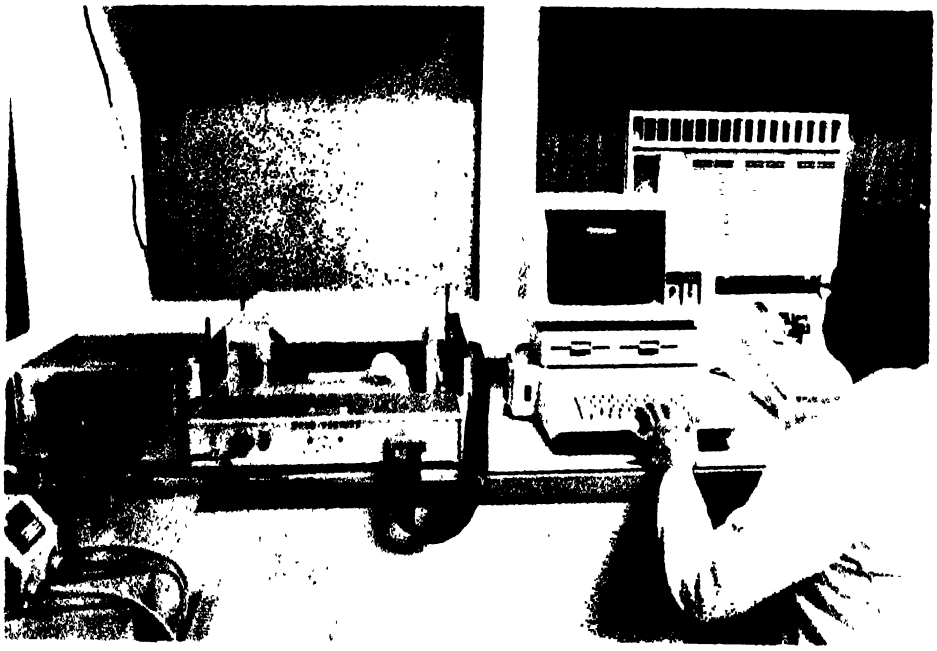
Many reference monographs, state-of-the-art documents, manuals on methodology, reviews and survey reports brought out by the Centre have been instrumental in prescribing

regulatory policies for the nation. ITRC has been constantly interacting with the Bureau of Indian Standards (BIS) for setting up national standard guidelines and with ICMR, Department of Environment, Pollution Control Boards, Defence Research Organisations, ICAR, Ministries of Health, Labour, Agriculture and many others in various regulatory matters. There are several instances of ITRC's work being the basis for the formulation / modulation / modification of regulatory norms in chemical risk assessment and control. The use of a few substances has been banned and of many restricted on the basis of ITRC's expert advice. ITRC's efforts during the Bhopal gas tragedy and followup are well recognized. The Centre has rendered yeoman's service to the success of the National Mission on Drinking Water, by assessing pathogenic microorganisms and pollutants in 13 states, and developing safety norms, proper methodology, portable water analysis kit and mobile water testing laboratory.

In addition to basic and applied R&D and regulatory expertise, the Centre has made significant contribution to the creation of mass awareness among the people. The work done regarding the prevalence of non-permitted and toxic food-dyes and additives, safe use of pesticides and development of consumer protection standards for detergents are some such instances. Exhibitions, popular publications in official and regional languages, audio-visual programmes, open houses, popular lectures, etc. have greatly helped in the awareness creation. ITRC has been playing a major role in environmental awareness programmes, and in training personnel in various aspects such as toxicology, safety evaluation of chemicals, occupational health, analytical methodology through national and international training courses. During 1983-88, more than 450 scientists, engineers, technicians from various parts of the country received training at ITRC. several scientists from Pakistan, Bangladesh, Sri Lanka, Thailand and West Germany received training in the field of toxicology, at ITRC.



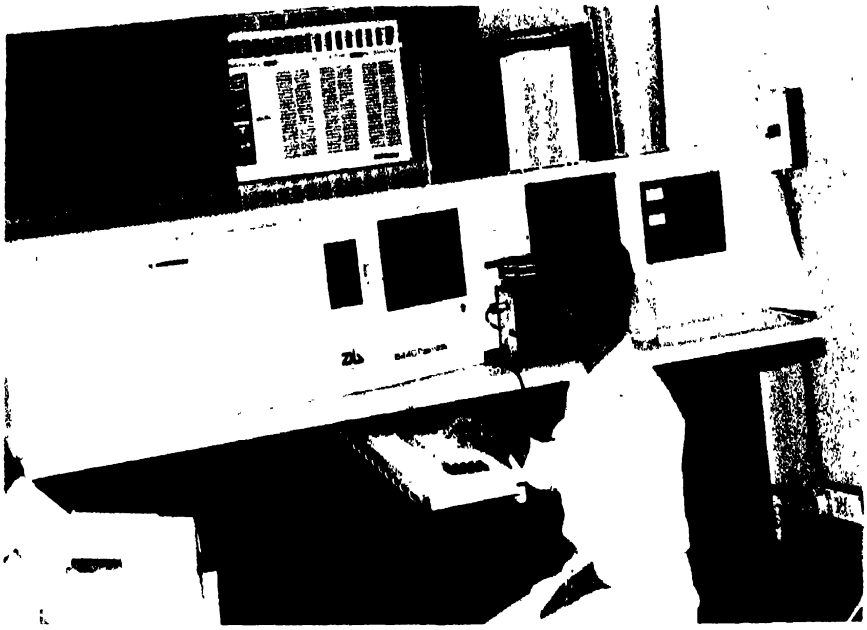
Elisa processor being used for immunological studies



Microprocessor controlled optovarimax, connected with video monitor, is being used for animal behavioural studies

Silver Jubilee Celebrations

ITRC started its year long Silver Jubilee Celebrations by holding a function in November 1989, inviting Prof. A.S. Paintal, FRS, Director General, Indian Council of Medical Research, New Delhi, to deliver the Silver Jubilee lecture and lay down the foundation stone of its new Silver Jubilee Block within the main campus of the institute. The other eminent scientists who attended the function included Dr S. Varadarajan, ex-Director General, CSIR and Prof. B.K. Bachhawat, former Director, IICB, Calcutta and Chairman, Technology Advisory Board of CSIR.



Inductively coupled plasma atomic emission spectrometer for metal analysis

Prof. P.K. Ray, Director, ITRC, on this occasion felicitated the three eminent scientists on behalf of the ITRC staff and himself by presenting scroll of honour and memento to each one of them. In addition, Prof. Paintal was decorated with a golden medal as token of honour for the silver jubilee speech delivered by him.

Prof. Paintal has made significant contributions in the field of physiology. His work includes: understanding of visceral sensory mechanisms, mode of action of chemicals on sensory receptors, pressure pain receptors of muscles, and discovery of J. receptors in the field of respiratory physiology which has sharply defined the 'pre-Paintal' and 'post-Paintal' era in this field of research.

In his address, Prof. Paintal expressed the hope that additional space created will be made available to existing scientists and no new disciplines will be added, because in his opinion each scientist requires some seclusion and optimally minimum space for him, in order to be more creative and productive.

Prof. Bachhawat has been deeply involved in the field of biochemistry and has numerous significant researches to his credit, which include: receptor-ligand binding and its implications in the field of neurobiology, relationship between abnormal glyco-conjugate metabolism and inborn metabolic errors leading to mental retardation. For the last 15 years, he has been deeply engaged in the area of liposome research and has contributed effectively to the development of technology for liposome encapsulated drug delivery system.

Prof. Bachhawat, in his address stressed on the importance of commitment to the cause of science. One has to take maximum advantage of the available facilities. Also, efforts should be made to develop capabilities and facilities so that more work of better quality is gradually evolved. In scientific persuits a scientist has to come out of superstitions and dogmas.

Prof. A.S. Paintal, Director General, ICMR, presenting scroll of honour and memento to Dr S. Varadarajan, former Director General, CSIR, on the occasion of silver jubilee function of ITRC

One has to be bold in experiments but cautious in his claims. Dr Bachhawat expressed his happiness over the outstanding performance of ITRC during the last 24 years.

Dr S. Varadarajan has distinguished himself for his original and outstanding contributions to the determination of the structure of nucleic acids, and has devised new method of production of C^{14} (radioactive carbon) labelled deoxynucleotides utilizing autotrophs. He has served as Chief Executive of a number of national organizations and bodies and Chief Consultant, Planning Commission, Government of India. His dedicated services during the Bhopal disaster will always be remembered, particularly his ability to manage the aftermath of that incident. Speaking on the occasion, Dr Varadarajan lauded the contributions made by ITRC towards achieving international standards in chemical safety in India.

Prof. P.K. Ray, Director, ITRC, in his welcome address enumerated a number of achievements of ITRC such as development of the water analysis kit to cater to the needs of water testing in the rural areas; mobile water analysis laboratory which can be employed even in the remote parts of the country where electric supply is not available and also in hilly areas; and *amrit kumbha* and 'Bact-o-kill' for providing bacteria, free drinking water. Prof. Ray also highlighted the role of ITRC in carrying out water analysis under the Ganga Action Plan. In near future, he said, ITRC will also be involved in Yamuna river monitoring and Hooghly river biomonitoring activities sponsored by the Department of Environment and Department of Ocean Development, respectively.

He also mentioned the role of ITRC in toxicity evaluation under the Oil Seed Mission, and in hazard and risk analysis of Hazira Gas Complex, Surat, in collaboration with TNO of the Netherlands and several other CSIR laboratories, responding to a global tender and winning over the tender in favour of CSIR. He also mentioned about the important role played by ITRC staff in clinical studies related to Bhopal gas exposed population and studies following MIC exposure in experimental animals.

Prof. Ray also mentioned the invaluable services rendered by Prof. S.H. Zaidi, the founder Director of ITRC, who could not be present on this occasion. Dr Zaidi was also felicitated, in absentia, on this occasion. □

Symposium on Nutrition and Drug Action

A symposium on Nutrition and Drug Action was organized by the Central Drug Research Institute (CDRI), Lucknow, in collaboration with the Roussel Scientific Institute, Bombay, on 16 December 1989. More than 100 scientists and medical doctors from India and abroad attended the symposium.

Inaugurating the symposium, Prof. J.C. Waterlow, former Chairman of FAO/WHO/UN Expert Committee on Energy & Protein Requirements, advised the developing and underdeveloped countries to give proper attention to the nutrition in their development programmes, since these nations are facing an acute problem of malnutrition owing to lack of protein, vitamins and minerals among the general masses.

Prof. B.N. Dhawan, Director, CDRI, emphasized the need for taking into consideration the nutritional aspects during medical treatment. He made it clear that the environment and nutrition, both play an equally important role in the treatment of disease. Explaining the tedious task of drug development and research, Prof. Dhawan reminded how one or two out of about ten thousand prospective compounds finally result into a useful drug. The development of a drug requires a large amount of money and endeavour of scientific and technical personnel over a period of 12-15 years. He informed that apart from the seven drugs that have been released to the market, four more drugs are in the clinical trial stage after which they may be marketed.

Shri P.K. Kakodkar, President of the Roussel Scientific Institute, Bombay, gave details about the activities of his institute engaged in the area of drug research.

Dr Kamla Krishnaswamy, an expert on nutrition from the National Institute of Nutrition, Hyderabad, delivered the keynote address in which she outlined as to how the

During the symposium on 'Nutrition and Drug Action' seen on the dais (from left) are: Dr K. Krishnaswamy, Dr P.K. Kakodkar, Prof. J.C. Waterlow and Prof. B.N. Dhawan

poor countries worldover are struggling to face the problem of malnutrition. In view of the varied response of drugs in different regions owing to malnutrition, the doctors are being advised to consider in detail the food habits and environmental aspects of each patient before prescribing any drug therapy.

Prof. Saroj Mehta, a paediatrician of the Post-Graduate Institute of Medical Education & Research, Chandigarh, stressed that a careful monitoring of therapy acquires an immense importance in view of the fact that about 70% of 0-5 years old children in almost all developing countries including India are suffering from severe protein energy malnutrition. She advocated for prescribing lower doses or to increase the interval between the doses.

Dr Nilima A. Kshirsagar, a noted pharmacologist of the Seth G.S. Medical College, Bombay, said that iron deficiency is one of the most prevalent nutritional disorders in the third world countries. She pointed out that over 20% Indian population suffers from iron deficiency and the incidence is higher among women of the child-bearing age. This aspect should be taken into consideration while administering drugs, particularly in case of drugs which have critical dose or plasma concentration requirement.

Dr O.P. Asthana of CDRI, pointed out that in the third world countries, malaria and malnutrition being highly prevalent, they frequently coexist in many areas and present a major public health problem. About 56% of the world population lives in areas endemic to malaria and India is a part of that area. In the Indian sub-continent, there has been a rapid resurgence of this disease mainly because of the development of resistance to anti-malarial drugs, indiscriminate use of these drugs and movement of the population from endemic to non-endemic areas. The CDRI scientist stressed the need to develop new anti-malarial drugs to control malaria.

The inaugural session was followed by three working sessions. A panel discussion on the role of nutrition and drug action was held in which opinions were expressed by Dr R.C. Srimal, Deputy Director, CDRI, Dr B.B. Goitonde, ex-Public Health Administrator, WHO, Geneva; Prof. B.N. Singh, KGMC, Lucknow; Prof. S.S. Agarwal, SGPGI, Lucknow and Dr S. Srinivasan, RSI, Bombay. Prof. B.N. Dhawan, Director, CDRI and Prof. S.S. Parmar, University of North Dakota, Grand Fores, USA, moderated the panel discussion.

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Fourth International Symposium on Frontiers of Electrochemistry

The Society for Advancement of Electrochemical Science and Technology (SAEST), in collaboration with the Central Electrochemical Research Institute (CECRI), Karaikudi, organized the Fourth International Symposium on 'Frontiers of Electrochemistry', in Madras, during 14-16 November 1989. The symposium was co-sponsored by CSIR; DST; Dhrangadhra Chemical Works Ltd, Sahupuram; Grasim Industries Ltd, Bombay; High Energy Batteries (India) Ltd, Mathura, Mettur Chemical and Industrial Corporation Ltd; and the Titanium Equipment and Anode Manufacturing Co. Ltd, Madras. Over 300 delegates from Brazil, Bulgaria, Canada, Hungary, India, Italy, Japan, Saudi Arabia, UK, USA, USSR, Vietnam and West Germany attended the symposium.

The topics covered in the symposium included: Membrane cell technology, High energy density batteries/fuel cells, Concrete corrosion, Amorphous and composite materials, Pollution control, Electrocatalysis/underpotential deposition, Photoelectrochemistry, Cyclic voltammetry & Electroanalytical techniques, Electrobiology, Conducting polymers/electropolymerization, Plating for electronics, Mass transfer in electrochemical reactors, Water electrolysis/hydrogen production and Electrorefining for superpurity metals.

Prof. Roger Parsons, FRS, University of Southampton, inaugurated the symposium. In his address he traced the history of the advances made in electrochemistry. Starting from the William Grove's discovery of the principle of the fuel cell, he referred to the contributions made by Galvani, Humphry Davy, Michael Faraday, UR Evans and others Also, he complimented SAEST for its multifarious activities for the advancement of electrochemical science and technology in India.

Presiding over the inaugural function, Dr K. Balakrishnan, Vice President, SAEST, highlighted the activities of SAEST.

Prof. S.K. Rangarajan, Chairman of the organizing committee and Director, CECRI, in his welcome address spoke about the various technologies developed by his institute.

Shri S.K. Jain, Managing Director, Dhrangadhra Chemical Works Ltd, released the souvenir brought out on the occasion, and Dr N.S. Rengaswamy, Secretary, SAEST, proposed a vote of thanks.

Technical Sessions

Twenty-two invited lectures were delivered under seven technical sessions:

Session I: Specific ionic adsorption (Prof. Roger Parsons, UK) and Impedance spectroscopy — A unified approach (Prof. S.K. Rangarajan) (Chairman: Dr K.S. Rajagopalan).

Session II: Unsolved problems of electrode kinetics and their probable solutions in the areas of electrochemical power sources and of corrosion of metals (Prof. S. Sathyanarayana), New Developments in the theoretical research on ion selective electrodes (Prof. E. Pungor, Hungary) and Electrochemical fluorination and its appli-

cation (Prof. P. Sartori, West Germany) (Chairman: Dr H.V.K. Udupa)

Session III: Environmental influences on materials and technical systems and their simulation (Prof. K.F. Ziegahn, West Germany); Substrate and additive effects on morphology of lithium deposited from organic electrolytes (Prof J.O. Besenhard, West Germany) and Energy storage with semiconductor — Septum cell, (Prof. S.H. Pawar), (Chairman: Dr A.K. Vijh)

Session IV: Design and performance of electrochemical reactors (Prof F.C. Walsh, UK) and Some aspects of initial stages of metal depassivation (Prof. Yu. I. Kuznetsov, USSR (Chairman: Prof. S. Sathyanarayana).

Session V: Electrochemically formed optical composites (Dr S.R. Rajagopalan), Electrocrystallization (Prof E Budevski, Bulgaria), New developments in the theoretical research on ion selective electrodes (Prof. F Pungor, Hungary), Photoelectrochemistry of metal oxides (Prof. W.J Plieth West Germany) and Challenges and opportunities in chlor-alkali industry (Dr B V Tilak, USA) (Chairman Prof. W.J Plieth)

Session VI: Vibrational spectroscopy to probe surface and solvent effects in electrochemical systems (Dr P.P. Schmidt, USA), Mechanistic aspects of electroless metal deposition—New techniques and results (Prof. K G. Weil, West Germany), Electrochemical cold fusion and hot confusion — (Dr Ashok K. Vijh, Canada), Stochastic simulations of surface structural effects in UPD electrocatalysis (Prof. K. Juttner, West Germany) and Electroorganic reaction utilizing halogen mediators: Electrochemical oxidation of enolic type and enamine type compounds (Prof Y. Matsumura, Japan) (Chairman. Prof. K.I. Vasu)

Session VII: Membrane Cell technology (Prof. M. Lakshmanan) and Electrochemical aspects of stress corrosion cracking — Prof. U.K. Chatterjee (Chairman: Dr B.V. Tilak)

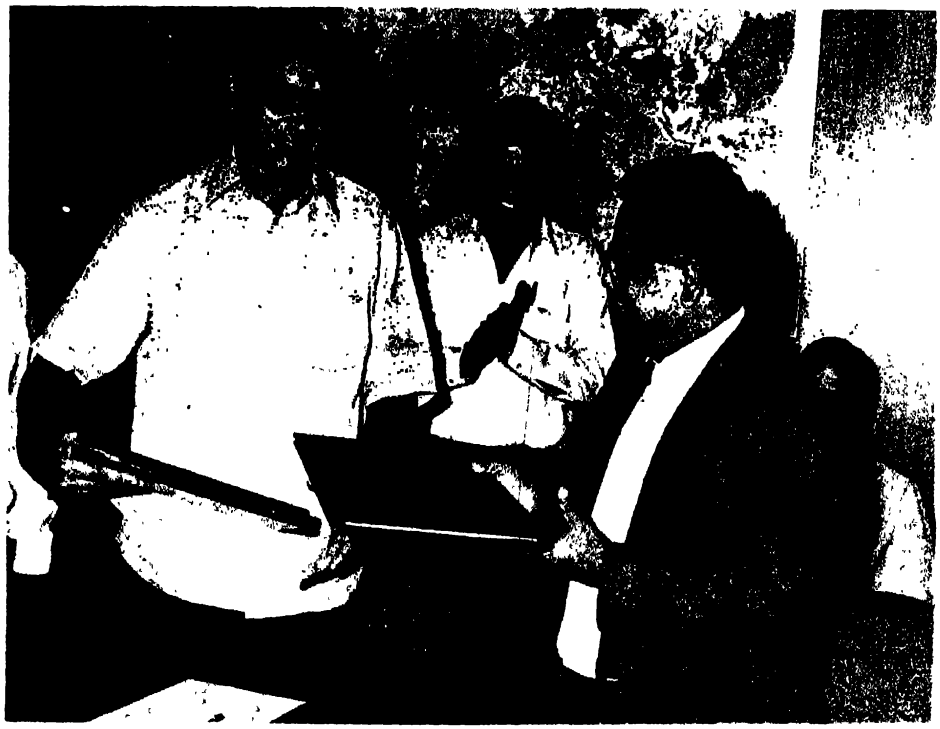
In addition, about 230 papers were presented as posters in six poster sessions devoted to: Corrosion; Corrosion & Batteries; Electrodics, Biology and Pollution Control; Electrochemical Techniques, Oxidation & Material Characteristics, Photoelectrochemistry and Semiconductors; Electrochemicals & Electrometallurgy and Metal Finishing.

Also, a panel discussion was held on 'Electrochemistry — Challenges and Opportunities'. Prof. Roger Parsons initiated the discussion and six CECRI scientists made brief presentations on challenging problems in various disciplines: Electrodics, Electrobiology & Pollution Control (Dr G. Prabhakara Rao), Corrosion Science & Engineering (Dr K. Balakrishnan), Industrial Metal Finishing (Dr S. Guruviah), Electrochemicals (Dr K.C. Narasimham), Electrometallurgy (Dr S. Viswanathan), and Electrochemical Material Science (Shri A.S. Lakshmanan). Prof. S.K. Rangarajan summed up the proceedings.

An exhibition was also arranged on the occasion, in which the following firms exhibited their products: *p*H Products Co., Hyderabad; Komal Agencies, Bombay; Micro Devices and Computers, Bombay; KLB Instruments, New Delhi; Titanium Tantalum Products (P) Ltd, Madras; Toshniwal Bros. Ltd, Madras and TEAM, Madras. □

CSIR-DOD Memorandum of Understanding

At a simple function held in the Department of Ocean Development, DOD, Government of India, New Delhi, on 19 March 1990, a revised Memorandum of Understanding (MoU) was signed by the Director General, CSIR and the Secretary, DOD. The earlier MoU, signed in



Prof. Vinod K. Gaur, Secretary, DOD and Dr A.P. Mitra, Director General, CSIR, exchanging the MoU document

October 1986, has been revised to expand the scope of work and strengthen the existing collaborative arrangements in the present day context. Future R&D needs in the area of environment impact studies and sea bed mining have now been included. The membership of the Board of Management, an apex body for the overall management of the programme, has also been expanded. The modified composition of the Board of Management is as follows:

Chairman: Secretary, Department of Ocean Development.

Members: Director General, CSIR; Additional Secretary, DOD; Joint Secretary, DOD; Financial Adviser, DOD; Four representatives from CSIR national laboratories participating in the project, viz., NIO, Goa; NML, Jamshedpur; RRL, Bhubaneswar and CMERI, Durgapur; Director, NPOL; and Representative of the Department of Mines (Joint Secretary or above).

Member Secretary: Officer on Special Duty, Project Cell, DOD.

While the Board of Management will continue to provide policy guidelines for the programme, the CSIR Steering Group recently constituted by DG, CSIR, will prepare short-term and long-term project programmes, evolve coordination mechanisms within CSIR and with the support of universities and other institutions, monitor the progress and facilitate cooperation and mobility of personnel between the participating laboratories.

The revised MoU imparts new direction and greater thrust to the joint efforts of this nationally important programme and is expected to usher in a new era of coordinated research and development effort. □

Exhibition of Indian Scientific & Technical Publications in Hanoi

The Indian National Scientific Documentation Centre (INSDOC), New Delhi, organized an exhibition of Indian S&T books and journals in Hanoi, Vietnam, during 12-17 February 1990. This was the first exhibition of Indian S&T publications held in that country.

The exhibition was organized under an agreement between CSIR, Government of India and the State Committee for Science and Technology of Vietnam. INSDOC was entrusted with the responsibility of procuring books and journals for the exhibition; the Central Library for Science & Technology (CLST), Hanoi, assisted in the organization of the exhibition.

A total of 725 books and 606 journals were displayed at the exhibition. A number of books and journals for the exhibition were gifted by government agencies like ICAR, INSA, DST, CSIR and several reputed publishers. Proceedings of some important conferences held in India were also included in the display. The books and journals on display covered practically all the areas of science and technology. A number of newsletters and annual reports of government institutions were also included.

The total worth of books exhibited was around Rs 89,000 and that of the journals around Rs 13,000. As per the agreement between the two countries, the exhibited books and journals were gifted to CLST.

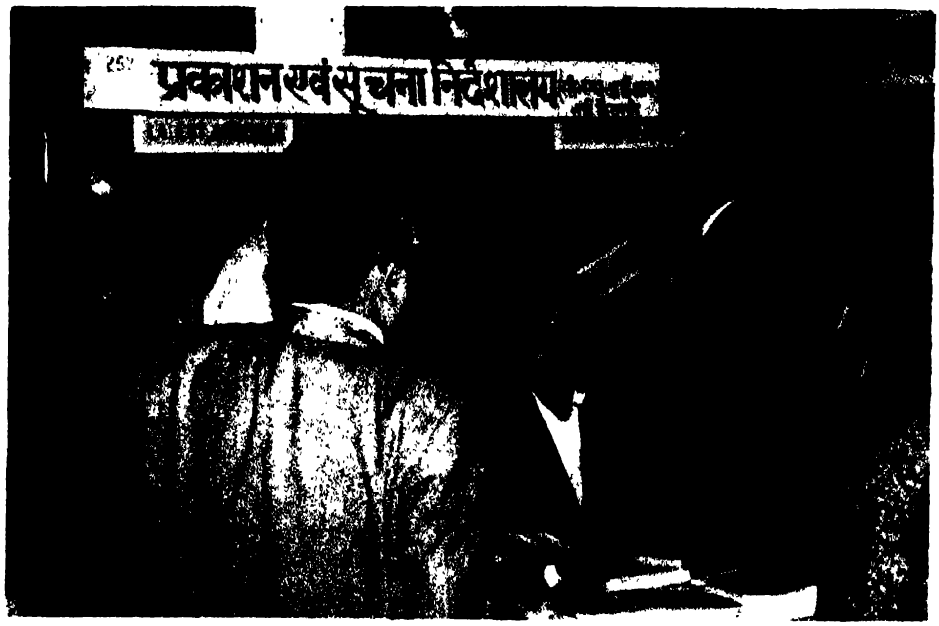
The exhibition was inaugurated by Shri J.C. Sharma, Indian Ambassador to Vietnam; Prof. T. Viswanathan, Director, INSDOC, presented the books and journals to the Director of CLST. Among the dignitories who visited the exhibition were Mr Dang Huu, Chairman, State Committee on Science & Technology; Prof. Le The Trung, Chairman, Institute for Medical Science for the Army; Mr Dang Ngoc Dinh, Head of National Information Institute for Science & Technology; Dr Dguyen Truong, National Institute of Science. A large number of scholars and scientists visited the exhibition and showed keen interest in Indian S&T publications. □

A view of the exhibition of Indian Scientific & Technical Publications, in Hanoi

PID participates in Ninth World Book Fair

The Publications & Information Directorate (PID), New Delhi, participated in the Ninth World Book Fair held at Pragati Maidan, New Delhi, during 13-18 February 1990. Organized by the National Book Trust in collaboration with several publishing federations and associations, the fair was inaugurated by the Vice President, Dr Shankar Dayal Sharma.

About 130 CSIR publications were displayed at the PID stall, which comprised research journals, popular science magazines, encyclopaedic publications, monographs, bibliographies, symposia proceedings and other miscellaneous publications. Children books in different Indian languages were also displayed. Thousands of people, including school/college students, visited the PID stall, and subscriptions to the tune of Rs 40,000 were booked □



A view of the PID stall at the Ninth World Book Fair

Parasite Bank at CDRI, Lucknow

A Parasite Bank is being established at the Central Drug Research Institute (CDRI), Lucknow, for the benefit of Indian scientists involved in research on filariasis, malaria and leishmaniasis. Initially, the bank would have the following strains of parasites:

A. ***Filarids***: (i) *Litomosoides carinii* in cotton rat/*Mastomys natalensis* and albino rat through vector mite, *Liponyssus bacoti;* (ii) *Acanthocheilonema viteae* in *Mastomys natalensis*/Hamsters through tick vectors, *Ornithodoros moubata;* (iii) *Brugia malayi* in *Mastomys natalensis/ gerbils (Meriones unguiculatus)*/langurs *(Presbytis entellus)* through mosquito vector, *Aedes aegypti.*

B. ***Leishmania* sp.**: (i) *Leishmania donovani* (Dd8) in Hamsters/Balb C mice/monkey; (ii) *L. donovani* promastigotes from *in vitro* cultures; (iii) *L. donovani* amastigotes from cultured macrophages.

C. ***Plasmodium* sp.**:I. Susceptible species/strains: (a) Human — *P. falciparum* (cryopreserved): (b) Simian — *P. cynomolgi,* Gombak, London, Mulligan, Ro, Langur, Ceylon, Cambodian B, and *P. knowlesi* W_1, H strains and (c) Rodent—*P. berghei* (K-173) (*in vivo* blood passage maintained) and *P. berghei* (NK 65) (*in vitro* sporozoite passage maintained).

II. Drug resistant species/ strains: *P. falciparum*, *P. berghei* (mefloquine and quinine resistant), *P. berghei* (chloroquine resistant), *P. berghei* (mefloquine resistant), and *P. yoelii nigeriensis* (multiple resistant to chloroquine, mefloquine and quinine).

The bank would, in due course, make available seed parasites/cultures/ strains and disseminate methods/ techniques for rearing and production of parasite materials. It is also proposed to conduct regular workshops and seminars on exchange of expertise on new techniques for laboratory production of target parasites and creation of suitable host-parasite systems.

It is hoped that scientists from different laboratories, institutes, medical and veterinary colleges, universities, etc. would be benefited from this facility and cooperate by intimating the bank regarding the strains of filarial, leishmanial and malarial parasites they have got with them, so that if need be, they can be procured and a National Register on availability of these parasites may be maintained.

Correspondence for procurement of strains may be addressed to : The Director, Central Drug Research Institute, Chattar Manzil, Post Box No. 173, Lucknow 226001. □

Micronutrient Availability and Interaction in Soil, influencing Yield and Quality of Opium Poppy

Opium poppy is grown in light textured soils of medium to high fertility. Most of these soils, which are cropped by high yielding varieties of other arable species during rest of the year following a very intenstive cropping

pattern, are subjected to micronutrient deficiency. Moreover, luxuriant use of the high analysis straight chemical fertilizers (which do not contain any micronutrient) and exhaustive uptake of nutrient elements from soil by these high yielding crops, make the soil deficient in micronutrients. Interaction effects of the micronutrients in soil as well as in plants significantly influence the availability of the micronutrients.

In the field experiments conducted during 1983-84 and 1985-86 at the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, it was observed that Mn, Fe and Zn significantly influence the yield and quality of opium poppy, and the influence of the levels of these elements varies with the fertility status of the soil.

Latex and seed yield significantly increased over control with the application of 5 ppm Zn and 7.5 ppm each of Mn and Fe. Increase in the doses beyond these levels resulted in the reduction of yield. Interaction effects of the levels of nutrients were maximum when 7.5 ppm Mn was applied with 7.5 ppm Fe or 5 ppm Zn. Continued application of 7.5 ppm Mn either with 7.5 ppm Fe or 5 ppm Zn increased seed and latex yield by 85 and 25% respectively, over control.

Among the alkaloids, morphine content significantly increased up to the application of 15 ppm Mn, 15 ppm Fe or 10 ppm Zn. Morphine and codeine concentration in the latex increased by 25-50% with the combined application of 15 ppm Mn with 7.5 ppm Fe or 5 ppm Zn. However, the per cent content of codeine, narcotine and thebaine was highest when 7.5 ppm Mn was applied with either 7.5 ppm Fe or 5 ppm Zn.

Studies on Chitosan acting Enzyme from *Rhotorula gracilis* CFR-1

An enzyme which acts on chitosan is found in the culture filtrate of *Rhotorula gracilis* and it is apparently consistently produced. The enzyme acts on chitosan solution, drastically reducing its viscosity. Shri D. Somashekar, a CSIR research fellow, while working at the Central Food Technological Research Institute, Mysore, partially purified the enzyme and studied some of its properties.

The yeast *R. gracilis* was grown on YEPD for about 48 h. The culture filtrate of 48 h was raised to 80% saturation with ammonium sulphate. The precipitate was passed through Biogel p-100 and fractions were assayed for activity. The active fractions were pooled and concentrated with 80% ammonium sulphate. The precipitate was again passed through Biogel p-300 and fractions were assayed for activity. The active fractions were pooled and used for studying the properties of the enzyme. The partially purified enzyme showed 4 bands in SDS PAGE. The enzyme was found to be optimally active at *p*H 4.5, 50°C. The enzyme was stimulated by Co^{2+} but inhibited by Zn^{2+}, Mn^{2+} and Hg^{2+} The enzyme was found to be stable at *p*H 5.0, 4°C. The apparent Km was found to be 4 mg/ml.

Various attempts to detect the enzyme catalyzed products by using conventional procedures have not been successful Therefore, some other methods like Biogel p-300 permeation, ultracentrifugation and high voltage electrophoresis were tried to characterize the products of enzyme hydrolysis.

Biogel p-300 permeation: The hydrolyzed and unhydrolyzed samples of chitosan were passed through Biogel p-300. The samples were eluted with 0.1 M NaCl and the fractions were assayed for total sugars by anthrone method. A distinct profile of the products, quite different from that of the substrate, was noticed.

High voltage electrophoresis: The hydrolyzed and unhydrolyzed samples were spotted on the cellulose acetate paper and electrophoresis was carried out in borax-boric acid buffer *p*H 7.75 at 7 mA, 400 volts for 15 minutes. The hydrolyzed sample showed a distinct band and the unhydrolyzed sample did not move properly.

Ultracentrifugation: The hydrolyzed and unhydrolyzed samples were run at 60,000 rpm for about 2 h. The ultracentrifugation analysis suggests that the substrate is probably converted into products approximately half its molecular weight.

All these data suggest that the enzyme probably cleaves the substrate into a much bigger product, which could not be identified by aforesaid methods.

The nature, mode of enzyme action, characterization of the products and biological role of this enzyme are being studied.

Shri Somashekar worked under the supervision of Dr Richard Joseph of CFTRI, Mysore. □

NEW PUBLICATIONS

PTC-Lucknow Publications

The CSIR Polytechnology Transfer Centre (PTC), Lucknow, has brought out its annual report for 1988-89 and two other publications, viz. *CSIR Institutions in Uttar Pradesh* and *Technologies for Rural Development* [Gramin Vikas ke liye Produgiki (in Hindi)].

PTC-Lucknow Annual Report: 1988-89—The report shows that the PTC played a significant role in the direction of commercialization of a number of processes/products, e.g. Papain from papaya latex, Iodized salt, Bottling of sugarcane juice, Mini wheat mill, Rust converter and Wastewater treatment. The centre was also associated with the holding of demonstration-cum-training camp on Ferrocement Rain Water Harvesting Structures, at Dehra Dun, and inspection of iron removal plants in Mirzapur.

The report also mentions the various meetings/seminars attended by the Project Officer of the Centre.

CSIR Institutions in Uttar Pradesh—This publication gives information on

R&D activities and significant achievements and facilities available at CSIR institutes/laboratories, extention centres and the Polytechnology Transfer Centre in U.P. The institutes included are: Central Building Research Institute, Roorkee; Central Drug Research Institute, Lucknow; Central Institute of Medicinal and Aromatic Plants, Lucknow; Indian Institute of Petroleum, Dehra Dun, Industrial Toxicology Research Centre, Lucknow; National Botanical Research Institute, Lucknow and the Structural Engineering Research Centre, Ghaziabad.

The extension centres covered are: CFTRI Regional Centre, Lucknow; CGCRI Regional Centre, Khurja; CIMAP Regional Centre, Pantnagar; CLRI Regional Centre for Extension & Development, Kanpur; NBRI Betel vine Research Centre, Mahoba and NEERI Zonal Laboratory, Kanpur.

Gramin Vikas ke liye Produgiki—CSIR has developed a large number of technologies for the benefit of rural people. The title publication gives information regarding these technologies under the following four sections: Technologies for improvement in quality of life, Technology Missions, Technologies for employment generation and Agricultural technologies. In all 70 technologies have been covered: Food-15, Habitat-14, Health-7, Environment & Alternative Sources of Energy-7, Technology Mission-11, Employment opportunities and Agriculture-4.

Enquiries regarding these publications may be directed to: The Project Officer, CSIR Polytechnology Transfer Centre, C-46, Nirala Nagar, Lucknow. □

CONFERENCE BRIEFS

International Conference on Recrystallization in Metallic Materials

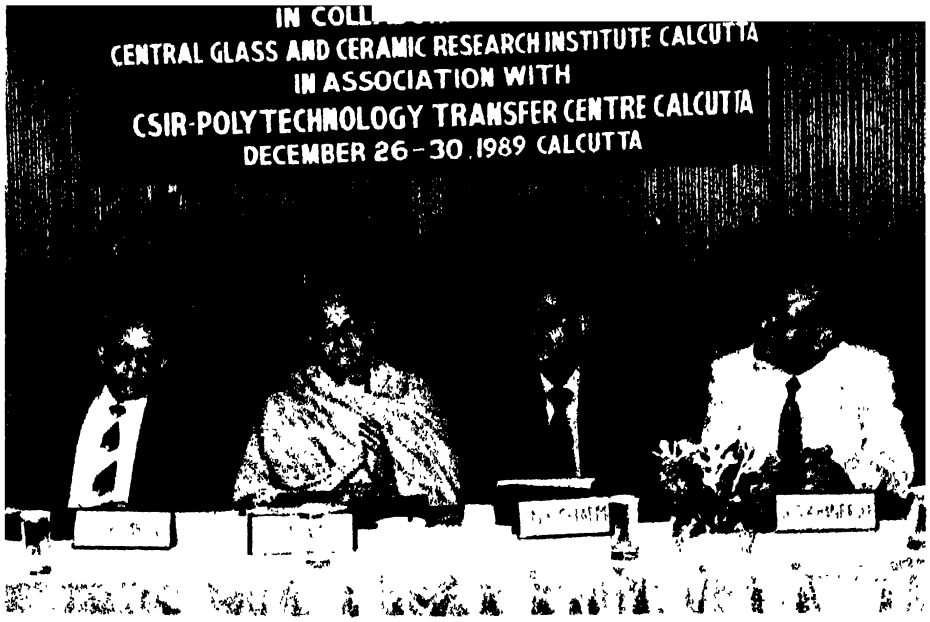
Dr K.G. Satyanarayana, Head, Materials Division, Regional Research Laboratory, Trivandrum, attended the International Conference on Recrystallization in Metallic Materials, held at the University of Woollongong, Australia, during 22-26 January 1990. He was elected Chairperson of the session on 'Recrystallization texture in non-ferrous materials'. Also, he gave an invited talk highlighting the work carried out at RRL-Trivandrum in collaboration with the Hindustan Aeronautics Ltd, Bangalore.

During his stay in Australia, Dr Satyanarayana visited COMALCO, a private company working on aluminium and its alloys/composites and BHP steels. Also, he held discussions with experts in the field of metallurgy/metal matrix composites. These included Dr Hansen of the RISO National Laboratories, Denmark; Dr Mohan S. Misra of the Martin Marietta Space Systems, USA; Dr M.P. Shaw of the University of Cape Town, South Africa; Dr A.W. Bowen of the Royal Aerospace Establishment, UK and Dr T. Srítharan of COMALCO. □

TRAINING COURSES

NRDC Training Programme on Management of Technology Transfer, Patents and Information Systems

The National Research Development Corporation (NRDC), New Delhi, in collaboration with the Central Glass & Ceramic Research Institute (CGCRI), Calcutta, and in association with the Polytechnology Transfer Centre, Calcutta, organized a training programme on 'Management of technology transfer, patents and information systems', in Calcutta, during 26-30 December 1989. Twenty-eight persons from private firms, banks, government concerns, consultancy firms, educational institutions, CSIR laboratories, etc. attended the training programme. The faculty consisted of the NRDC Managing Director, CGCRI Director, Professors of Jadavpur University, CSIR scientists, and experts from the Patent Office, banks and financial institutions. Prof. M.M. Chakraborty, former Vice-Chancellor,



Dr M.M. Chakraborty inaugurating the Thirteenth NRDC Training Programme

Jadavpur University and Kalyani Agricultural University, inaugurated the programme.

Shri I.R. Kumar of NRDC was the Programme Coordinator and Dr S.K. Banerjee, Scientist, CGCRI, the local Coordinator. □

NISSAT-INSDOC Training Courses on Computer Applications to Library & Information Activities

The seventh course on Computer Applications to Library and Information Activities was held at the Indian National Scientific Documentation Centre (INSDOC), New Delhi, during 18 December 1989-12 January 1990. The 13 participants who attended the course were trained in the MS/DOS Operating System and various software packages like Wordstar, Lotus 123, dBase III plus and CDS/ISIS.

The eighth course was held from 5 February to 2 March 1990. In this course, CDS/ISIS version 2.3 was taught in addition to the above pac-

Eight more courses will be organized during April 1990-March 1991. □

Prof. H.G. Sharat Chandra takes over as Director, CCMB

Prof. H.G. Sharat Chandra of the Indian Institute of Science (IISc), Bangalore, has been appointed Director of the Centre for Cellular and Molecular Biology (CCMB), Hyderabad, w.e.f. 1 March 1990. He took over charge from the outgoing Director, Dr P.M. Bhargava, who retired on 28 February 1990. At IISc, Prof. Sharat Chandra was heading the Microbiology and Cell Biology Laboratory as well as the Centre for Theoretical Studies.

Prof. Sharat Chandra (born 11 March 1938, Bangalore) obtained his Ph.D. degree from Berkeley (USA). He worked for several years on the cytogenetics and mechanism of sex determination in the mealy bug and in mammals. In addition to experimental studies, he along with his associates, proposed provocative models for sex determination in these

systems. Prof. Sharat Chandra is also interested in studying the role of methylation in mammalian X-chromosome inactivation.

Prof. Sharat Chandra is a fellow of the National Academy of Sciences, the Indian National Science Academy, and the Indian Academy of Science, of which he has been a Secretary since 1986. Before joining CCMB, he was associated with the Centre as a Member of its Executive Committee and Research Advisory Council. □

Five NML scientists felicitated for their outstanding contributions

Five scientists of the National Metallurgical Laboratory (NML), Jamshedpur, were felicitated for their outstanding achievements, at a function organized for the purpose on 18 January 1990, at NML. Dr. A.P. Mitra, Director General, CSIR, who was the Chief Guest, felicitated the scientists. The scientists made presentations on the significant contributions made by them.

Dr D.D.N. Singh, winner of the CSIR Young Scientist Award-1989, in his presentation, gave a detailed account of his contributions in the field of corrosion and inhibitors.

Dr Inder Singh was felicitated for winning the prestigious MASCOT National Award 1988 at the Annual Technical Meeting of Electrochemical Society of India. In his presentation, he explained the function of vapour phase inhibitor which has been developed at NML and has led to a number of interactive programmes with TCIL and TELCO.

Dr O.N. Mohanty, recipient of 27th National Metallurgists' Day Award 1989, was felicitated for his contributions in the field of phase transformation, thermodynamics and kinetics, and X-ray diffractometry. His presentation covered the following topics: (i) Understanding phase transformation, particularly with the aid of less common techniques; (ii) Development of alloys with special properties; and (iii) Generation of new information on spark machined surfaces of steels and also on rapidly solidified cast irons.

Shri K.P. Mukherjee was felicitated in recognition of his outstanding contribution through consultancy services. He gave an overview of his contribution in the field of corrosion prevention and its protection, with particular reference to the services rendered towards the construction of the second Hooghly Bridge, Calcutta, to Braithwaite, Burn and Jessop Construction Co. Ltd. NML services involved: advice, inspection and certification for the entire rectification treatment for corrosion protection of the steel girders. As a result of this work a time overrun of one year in the construction of the bridge could be avoided.

Dr R.N. Ghosh was felicitated for his commendable work in providing consultancy services to the National Physical Laboratory, London. He was awarded an assignment, on contract, for developing the following additional modules which would extend the scope of CRISPEN—a physics based model for creep strain prediction of engineering alloys by a significant factor: (1) A unified model

for prediction of strain under complex uniaxial loading and (ii) A constitutive model for simulating creep behaviour of single crystal super alloy of arbitrary orientation. □

Honours & Awards

Dr D.K. Ganguly

Dr D.K. Ganguly, Scientist F, Indian Institute of Chemical Biology (IICB), Calcutta, has been elected as Dean, Indian Academy of Neurosciences for the year 1990-91. Also, he has become Member-Secretary, Indian National Committee for International Union of Pharmacology for three years and Foreign Member, Society for Neuroscience, Washington, with effect from 1989.

Dr (Smt) Anita Pakrashi

Dr (Smt) Anita Pakrashi, Scientist, Indian Institute of Chemical Biology (IICB), Calcutta, has become a full member of the Third World Organization for Women in Science. □

ANNOUNCEMENTS

Industry Oriented Technology Courses at CECRI

The Central Electrochemical Research Institute, Karaikudi, will be conducting the following Industry Oriented Technology Courses in 1990:

A. *Electrochemical Materials Science; Electrodics, Electrobiology and Pollution Control; Electrochemical Electronics and Instrumentation:*

(i) Basics of Electrochemistry (2-7 July)
Coordinator—Dr P. Radhakrishnamurthy
Course charges — Rs 750

(ii) Electrochemical Pollution Control and Monitoring with special reference to Electrochemical Industries (9-14 July)
Coordinator—Dr R. Vijayavalli
Course charges—Rs 750

(iii) Electrobiology (16-21 July)
Coordinator—Shri K.S.A. Gnanasekaran
Course charges—Rs 750

(iv) Microprocessors and Their Applications (23-27 July)
Coordinator—Shri C. Srividyarajagopalan
Course charges—Rs 750

B. *Corrosion Science and Engineering*

(i) Corrosion Science and Engineering (General) (30 July-4 Aug.)
Coordinator—Shri Y.V.P. Ramachandra Row
Course charges—Rs 750

(ii) Cathodic Protection Systems and Devices and Anodic Protection (6-10 Aug.)
Coordinator—Shri N. Palaniswamy
Course charges—Rs 750

(iii) Inhibitors for Corrosion Prevention (13-17 Aug.)
Coordinator—Dr G. Venkatachari
Course charges—Rs 750

(iv) Biofouling and Marine Corrosion (20-25 Aug.)
Coordinator—Shri K. Chidambaram/Shri G. Rajagopal
Course charges—Rs 850

(v) Corrosion of Steel in Concrete (27-31 Aug.)
Coordinator—Dr N.S. Rengaswamy
Course charges—Rs 750

(vi) Corrosion Control in Oil and Gas Production and in Refineries (3-7 Sept.)
Coordinator—Shri P. Subramanian
Course charges—Rs 750

(vii) Corrosion Control in Fertilizer Industry (10-14 Sept.)
Coordinator—Shri T.M. Balasubramanian
Course charges—Rs 750

(viii) Corrosion Control in Sugar Industries (17-21 Sept.)
Coordinator—Smt. C. Marikkannu
Course charges—7s 750

(ix) Pipeline Corrosion and Its Control (24-28 Sept.)
Coordinator—Shri R. Meenakshisundaram
Course charges—Rs 750

C. *Inorganic/Organic Electrochemicals and Electrometallurgy and Thermics*

(i) Water Technology (6-10 Aug.)
Coordinator—Dr K.C. Narasimham
Course charges—Rs 750

(ii) Caustic Soda and Chlorine Technology (13-18 Aug.)
Coordinator—Shri S. Krishnamurthy
Course charges—Rs 750

(iii) Technology of Inorganic Electrochemicals (20-24 Aug.)
Coordinator—Shri V. Rengarajan
Course charges—Rs 750

(iv) Technology of Organic Electrochemicals (27-31 Aug.)
Coordinator—Dr P.N. Anantharaman
Course charges—Rs 750

(v) Electrometallurgy of Aluminium and 1 Magnesium (1-5 Oct.)
Coordinator—Shri T. Selvin Devasahayam
Course charges—Rs 750

The minimum qualifications for each course are: Bachelor's degree in Chemistry, Physics, Metallurgy or Engineering or Polytechnic Diploma, relaxable in special cases of candidates who are otherwise suitable as entrepreneurs and candidates sponsored by employers.

For further details, please contact: Director, Central Electrochemical Research Institute, Karaikudi 623006.

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CSIR NEWS

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Bamboo has been coaxed to flower *in vitro* by NCL scientists (p. 106). Shown here are flowers of bamboo *in vitro*

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Biomedical Aspects of Ozone Depletion: UVB Effects*

P.C. JOSHI
Industrial Toxicology Research Centre, Lucknow

Introduction

During the past decade, researchers have obtained conclusive evidence to suggest that manmade chemicals are destroying the stratospheric ozone layer. Major change in O_3 thickness is likely to disturb photosynthesis, reduce crop yield, and the increasing UVB (290-320 nm) radiation, which will be filtered through to earth, will be toxic to all forms of unpigmented living cells to induce skin cancer, cataracts, inhibition of human response to infectious diseases and drastic reduction in plant yield and quality.

Chemical compounds known as chlorofluorocarbons (CFCs) which have been widely used as refrigerants and propellants in spray cans have been identified as an interesting source of pollutants that have been shown to destroy ozone.

CFCs are decomposed by shortwave ultraviolet light liberating chlorine atom (Cl) which reacts with O_3 to form O_2 and ClO. The latter reacts further with O_3 to liberate O_2 and Cl. The regeherated Cl leads to further breakdown of O_3 and a catalytic chain reaction is followed. It is estimated that with the generation of every 10 atoms of Cl, nearly a million O_3 molecules will be destroyed. Thus the continued use of CFCs will have to be restricted (Montreal Protocol).

Researchers are now engaged in developing CFC substitutes with comparatively low or no O_3 depletion potential. The Montreal protocol has come into effect since January 1989, according to which the existing CFCs will have to be replaced by ozone friendly substitutes before the end of this century. However, already there exists enough concentration of CFCs in the troposphere that in spite of a complete ban on the use of existing CFCs the stratospheric O_3 layer may keep on depleting. In view of the above, assessment of present status of knowledge on UVB effects and future predictions on adverse biological effects on account of continuing O_3 depletion need to be evaluated. Some of the biological effects of UVB radiation as a consequence of O_3 depletion are described here:

*Presented at the first meeting of CSIR Steering Group on Global Change, held on 20 February 1990 at CSIR Headquarters, New Delhi.

Dermal effects

Erythema is the most conspicuous response to UVB radiation on skin. It is induced by increased blood volume in the superficial and deep vascular plexi in the dermis and becomes visible when the volume of blood increases by one-third of the normal levels. The detectability of erythema varies according to the degree of constitutive or faculative pigmentation present. Erythema can be induced by a single UVB dose and is defined as the minimum energy required to produce visual erythema in the irradiated area of skin (minimum erythema dose or MED). Erythema begins several hours after UVB exposure and reaches a maxima between 12 to 24 h later. The colour fades over a period of several days with delayed tanning response or peeling of skin. Fair skinned people require 3 to 5 times less UVB radiation to induce erythema than the people with moderately pigmented skin and up to 30 times less than people with darkly pigmented skin. Histamine has been identified as a potential mediator in delayed UVB-induced erythema in human. A fourfold rise in histamine levels in human suction blister fluid has been demonstrated at the onset of UVB radiation induced erythema. Histamine level returns to normal in 24 h after radiation. Increased level of serotonin, a mediator also released from mast cells, has been shown in the urine of humans after UVB irradiation. Involvement of mast cells is also supported by the increased levels of prostaglandin D_2, predominantly a mast cell product found in human skin after UVB treatment. UVB also leads to increased epidermal melanin pigmentation which is a protective response of the skin against further radiation exposure. In man, mutliple exposures to UVB radiation are required for a demonstrable increase in melanocyte population to occur.

Incidence of skin cancer

Pigmented races, who sunburn not so easily as compared to white skin, have very much less probability of skin cancer, and when it does occur it usually affects areas not exposed to sunlight. Skin cancer can be produced readily on the skin of mice or rats with repeated doses of UV radiation below 320 nm, which coincides with spectral range that produces erythema in human skin. A quantitative relationship between O_3 thickness, UV radiation and erythemogenic skin reactions has been investigated by a number of workers.

Photodamage to the eye

Sunlight exposure, specifically the UVB radiation, is well recognized to be a cause of senile cataracts. Because solar UV radiation is present during most of the daylight hours, the eye may be exposed daily to some amount of solar ultraviolet radiation through-

out life. Wavelength below 290 nm are partially or completely absorbed within cornea and conjunctiva. The inflammatory reaction of the outer most layer of the eye (photokeratitis) to UVB radiation is similar to that of the skin in many respects. It has been reported that the action spectrum for cataracts begins abruptly between 293 and 297 nm, reaches peak near 297 nm and falls abruptly near 313 nm. Minimal effects exist through the remainder of the UVA.

Various lines of evidence suggest that cumulative damage to the macromolecules of the lens and the retina, by photochemical generation of active species of oxygen (singlet oxygen, superoxide radicals and hydroxyl ions) can account for some of the changes observed in these tissues in the diseased state. Photodamage to the tissues along the optic axis of the eye, namely the cornea, aqueous humour, lens, vitreous, retina and retinal pigment epithelium is, primarily caused by the wavelength of the absorption absorbed by each tissue. The cornea absorbs wavelength below 295 nm and transmits all longer wavelength radiation to the aqueous and lens. The lens contains chromophores which absorb between 295-400 nm and transmit wavelength lower than 400 nm to the retina. Calculations of UVB ocular dose from chronic exposure and those needed for experimental UVB cataratogenesis have shown a good agreement between the two. A legitimate concern is that an increase in the flux of UVB radiation, due to O_3 depletion, may lead to an increase in cataract incidences around the world. The initial photochemical event in cataractogenesis may be UVB absorption by tryptophan of lens proteins and generation of N-formylkynurenine (a well-known UVA photosensitizer). Kynurenine derivatives produced under the influence of UVB generate singlet oxygen (a reactive O_2 species) under UVA, resulting in cross-linking of crystalline protein. Likewise, there may be other hitherto unidentified chromophores which may aggravate the UVB effects to ocular tissues. The action spectrum for experimental cataracts in animals exposed to UV radiation indicates maximal sensitivity in the UVB range of about 300 nm.

Vitiligo (Leucoderma)

Vitiligo is a disease of unknown cause in which melanin pigment is lost from areas of otherwise normal skin. Melanin is developed by a stepwise oxidative polymerization of tyrosine in the presence of an enzyme, tyrosinase. UVB activates the enzyme in some way. The exact structure of melanin pigment is not yet known. The absence of pigment in the epidermis results in white patches and makes the affected areas of skin susceptible to solar UV radiation. Vitiligo can be acquired genetically or can be induced by chemicals. It is rising significantly in India and tropical countries, and especially among young children. With the result the victims of this pigmentary disorder are segregated from the society. India being a tropical country has abundance of natural ultraviolet from sunlight. Whether our vulnerability particularly in terms of excessive UVB or UVA exposure in the presence or absence of various exogenous/endogenous photosensitizer (environmental pollutants) has any role in the pathogenesis of vitiligo is not known. There is a possibility that the hypopigmentary lesions of vitiligo patients will become more vulnerable to UVB exposure leading to secondary disorders.

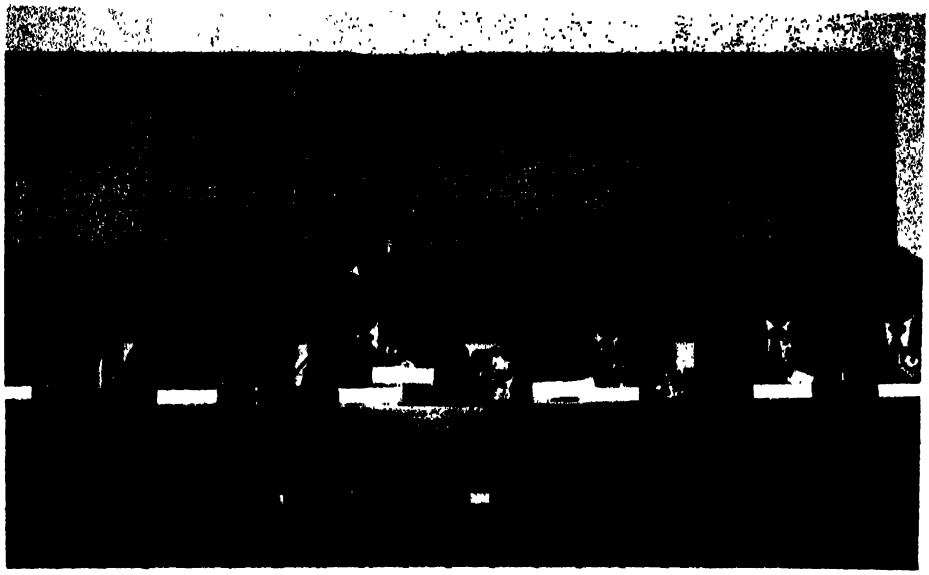
The involvement of UVB in vitamin D synthesis has considerable biological significance. Vitamin D exists in several forms: the form obtained by UVB irradiation on the skin is vitamin D_3 (cholecalciferol). In plant material the vitamin produced by UVB irradiation is vitamin D_2 (ergocalciferol), a photoproduct of UVB irradiation of ergosterol, common in some plants. Vitamin D (both D_3 and D_2) enters the cells of the intestinal lining and penetrates into the cellular nucleus, where it associates with the chromosomes, genetic material, after which it triggers the formation of a messenger molecule with specific instruction to create a protein that carries calcium (Ca^{++}). The protein transports calcium through the cells of the gut to the blood stream and ultimately the bones. The lack of solar ultraviolet light is known to induce rickets in mammals but the physiological role of overexposure of UVB is not known.

Only a few examples of the possible biological effects where UVB plays an important role have been cited. Even though, there is a possibility that the life on earth will eventually acquire adaptability to develop resistance to damage from UVB radiation, nevertheless, with a sudden increase in the UVB flux the repair systems could be overwhelmed leading to photomutation and photocarcinogenesis.

Reports have indicated that the O_3 layer has depleted 3-4% over the last decade and there are zones where seasonal depletion as high as 50% has been observed. The antarctic ozone hole may not be poised to global O_3 depletion but the discovery has certainly made researchers take an entirely new look over the issue of increased phototoxicity due to increase in atmospheric UVB. In view of the large abundance of solar UV in tropical countries and catalytic action of excessive humidity and heat, the ecosystem remains vulnerable to increased UVB risk. Outdoor activities in this area are enormous and awareness is nonexisting. Therefore, the need to study the evaluation of possible biomedical implications of UVB and its possible relevance to ozone depletion effect is worthwhile. □

National Seminar on Autoclaved Calcium Silicate Products

A National Seminar on Autoclaved Calcium Silicate Products was



At the inaugural function of the National Seminar on Autoclaved Calcium Silicate Products, seen on the dais are (from left): Dr R.K. Bhandari, Shri P.S. Bami, Dr Ram K. Iyengar, Dr R.B. Hajela and Shri S.P. Garg

organized by the Central Building Research Institute (CBRI), Roorkee, in New Delhi on 8 January 1990, to acquaint the promising entrepreneurs with the recent developments in the production of autoclaved building materials, viz. bricks, blocks and cellular concrete. Sponsored by the National Thermal Power Corporation, (NTPC), New Delhi, the seminar covered the following themes with regard to the productivity and economics of calcium silicate products: (1) Raw materials' availability and evaluation, waste materials utilization, (2) Technology of production, techno-economic feasibility, and (3) Scope of adoption of autoclaved calcium silicate products, feedback and case studies.

The seminar was inaugurated by Shri P.S. Bami, Chairman and Managing Director, NTPC and chaired by Dr Ram K. Iyengar, Additional Director General, CSIR. Over seventy-five participants took part in the deliberations.

Prof. Dinesh Mohan, former Director of CBRI, chaired the first technical session. Dr Mohan Rai, former Deputy Director and Head, Building Material Division, delivered a keynote address on Autoclaved Calcium Silicate (Sand Lime) Bricks. Six papers were presented, which were followed by discussions on various aspects of techno-economic feasibility, raw materials availability and their utilization, etc.

Dr S.K. Chopra, former Additional Director General, NCB, New Delhi, chaired the second technical session and delivered a keynote address on the Development of Cellular Concrete Industry. Three papers were presented in this session.

Following recommendations were made at the concluding session which was chaired by Dr R.K. Bhandari, Director, CBRI:

1. Availability of fly ash from thermal power plants, free of charge, should be ensured. The National Committee should take up the matter with the government.

2. Raw materials of uniform quality should be made available to the proposed autoclaved calcium silicate production units for which national labs like CBRI, RRL, R&D unit at NTPC, NCBM, etc. should provide facilities for raw material evaluation and characterization.

3. Greater awareness regarding the quality, performance and durability should be developed amongst manufacturers/users for the wide adoption of autoclaved calcium silicate products.

4. Government departments/construction agencies should be encouraged to use calcium silicate products in their civil works.

5. Package technology should be formulated for the manufacture of calcium silicate products.

6. The potential areas may be identified for the location of such plants in the country. □

25th Tanners Get Together

Perspectives, Policies and Plans for Leather Industry in Nineties: A Consensus

The Tanners Get Together (TGT) is an annual convention held at the Central Leather Research Institute (CLRI), Madras and attended by tanners, leather makers, traders, scientists, technologists and policy makers from India and abroad. The theme of this year's get-together (TGT 90) was: Perspectives, Policies and Plans for the Leather Industry in Nineties—A Consensus. The Council for Leather Exports, All India Skin and Hide Tanners and Merchants Association, Indian Leather Technologists Association and the Committee on Science and Technology in Developing Countries collaborated with CLRI in organizing the get-together.

TGT 90 was held in three technical sessions and a poster session. In addition to these, there were special lectures: Dr A.P. Mitra, Director General, CSIR, delivered the Nayudamma Science Foundation lecture on Science, Technology and National Development, and Dr H. Will, BASF, delivered the B.M. Das Memorial lecture on the Environmental Impact Assessment of Leather Finishing Chemicals.

Also included in TGT 90 was a

Shri P.C. Alexander inaugurating the 25th Tanners Get Together

demonstration programme in which CLRI scientists and leading manufacturers of leather and chemicals provided show-hows related to the technological advancements made in the field of leather science and technology.

The first technical session dealt with the perspectives and policies, and included five invited lectures; two of these were on government policies, two on the perceptions of the industry and one on the R&D perspectives.

The second technical session comprised three parallel sessions on: (i) Resource Management and Development, (ii) Effluent disposal, and (iii) Marketing management. Each parallel session had three presentations made by experts and a panel discussion. Topics covered in these sessions included: raw material scarcity, raw material resource development, human resource development, effluent disposal systems and regulations, and image building for Indian leather products in the international market.

The third technical session discussed 'targets and technologies'. Emerging technological developments in the areas of biotechnology, chrome-free tanning, leather processing, garment design and development, CAD/CAM for shoes and modernization courses for leather processing sector were highlighted in the form of presentations from eminent scientists and technologists from India and abroad.

Twenty-one papers were presented in the poster session.

The observations made at the get-together include: The Indian leather industry is poised for a rapid growth in the export sector and it should necessarily have built-in safeguards to protect itself against raw material shortages on one hand and the ineffective marketing channels in the international trade on leather products, on the other. The industry needs to take necessary measures for minimizing the ecological imbalances owing to tanning activity. In order to achieve the technology targets, a larger number of sufficiently trained manpower is necessary. The get-together also felt the need for some progressive policy inputs from the government, concerted action plan from the industry and the state of art technology from technical bodies.

A compilation of full text of many invited lectures and abstracts of all the papers presented in poster session has been published. Enquiries regarding copies of the publication may be addressed to: The Director, Central Leather Research Institute, Adyar, Madras 600020. □

Analgesic drug, DPH, prepared by CDRI technology, finds export market

A process developed by the Central Drug Research Institute (CDRI), Lucknow, for the production of Dextropropoxyphene hydrochloride (DPH), an analgesic drug, has been successfully used for commercial production by the Wockhardt Private Ltd, Bombay. Utilization of the CDRI technology by the firm has effected foreign exchange saving through import substitution, and its export to 11 countries has led to a foreign exchange earning to the tune of over Rs 10 million/annum.

Until recently, the country's entire need for DPH was met through imports. CDRI developed the process know-how for DPH as an inhouse project and the technology was transferred to the Wockhardt Ltd in 1984. The firm upscaled the process and put it into use for commercial production of the drug at their Aurangabad plant in 1987, thus earning the distinction of being the first Indian firm and the fourth in the world, next only to USA, Switzerland and Italy, to have manufactured the drug from basic stage. The Department of Scientific & Industrial Research, Government of India, recognized the effort of the Wockhardt Ltd by honouring it with the DSIR National Award (1988). The firm produced 19 and 45 tonnes of DPH during 1988 and 1989, respectively. After meeting country's requirement of about 20 tonnes during 1989, the firm exported 25 tonnes of this drug to USA, UK, Switzerland, France, FRG, Canada, Italy, Mexico, Cyprus, Denmark and Jordan. □

Third Meeting of the SAARC Documentation Expert Committee

The third meeting of the SAARC Documentation Expert Committee, which has representation of all SAARC nations, was hosted by the Royal National Academy of Science & Technology (RONAST), Kathmandu, during 6-8 February 1990. About 20 delegates from all the SAARC nations attended the meeting. Delegates presented their country reports highlighting the progress made by each national focal point of SAARC documentation system, since the last meeting held in April 1989 in Islamabad. The Data Entry Manual developed by India was discussed and adopted. The format for User Profile made by India and Nepal was also adopted. SAARC secretariat has been requested to work out modalities for the development of SAARC document collection in each national focal point of the SAARC documentation system. India, Nepal and Pakistan are to jointly develop a numbering system for the SAARC documents. The location of the SAARC Documentation Centre will be decided in the fourth meeting to be held in Dhaka next year.

The Indian National Scientific Documentation Centre (INSDOC), New Delhi, is the national focal point for SAARC documentation programme. The Indian delegation for the meeting comprised: Prof. T. Viswanathan, Director, INSDOC; Dr N. Vijayaditya, Director, NIC; Shri B.K. Sen, Scientist, INSDOC; Shri Ashok Tomar, First Secretary, Indian Embassy, Nepal and Shri Satbir Singh, Ministry of External Affairs, India.

□

Bamboo coaxed to flower *in vitro*

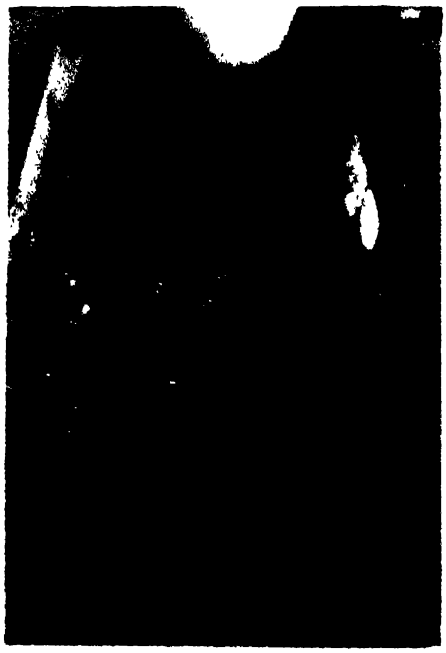
Bamboo trees are of great importance to eastern culture and permeate folklore and myths. In India, it is known as 'poor man's timber', the Chinese call it 'friend of the people' and the Vietnamese fondly refer to it as 'my brother'. Around 1250 species of bamboo are distributed worldwide. In India, over 100 species belonging to several genera are spread over different agroclimatic zones. However, the commercially important bamboo species are very few.

Bamboo is a multipurpose tree. The paper and pulp industries are the main consumers. In India, more than half of the bamboo production is used for making paper. Several cottage industries, such as those making baskets, furniture, toys, handicraft articles, thrive on bamboos. It is also a valuable source of fuel and food. In Taiwan, tonnes of pickled or stewed bamboo shoots are processed daily. Tribals consume bamboo shoots and seeds as their steady diet, leading to exhaustion of new shoots and depletion of bamboo stocks. The main diet of the giant panda, already on the endangered species list, is bamboo and its very survival depends upon the availability of bamboo shoots in adequate quantity, as much as 16 kg/day. Bamboo also plays an important role in the prevention of erosion, since the interlocking bamboo rhizomes keep saturated top soil firmly in place.

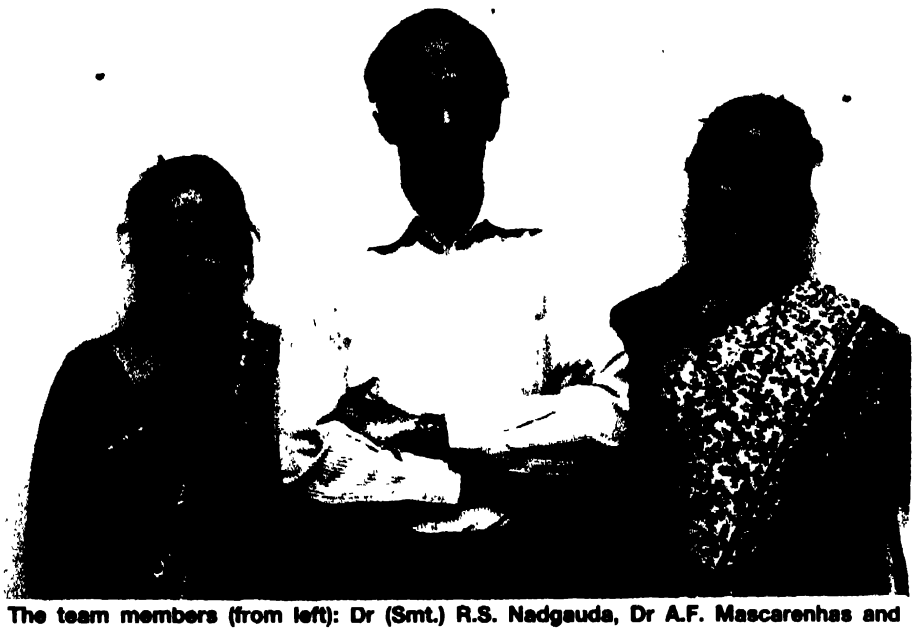
The propagation of bamboo is beset with inherent difficulties owing to the unpredictable flowering and seeding behaviour, with the result that only few species are presently exploited. Moreover, propagation by internodal culms treated with growth promoting substances is possible only with a few species. It is also propagated through rhizomes.

The flowering of bamboo is gregarious and most of the bamboo species flower only once in their lifetime (i.e. when they are 12-120 years old) and after this rare event the entire forest dies. In many forests, new seedlings, unprotected from cattle and fire, disappear and large areas are wiped out. Because of these reasons it is almost impossible to cultivate or improve the species. Moreover, as the normal seed generation time is so long and unpredictable in these plants, it has not been possible to mix the genes of different plants for evolving superior offspring.

Realizing these problems, a team of scientists from the National Chemical Laboratory (NCL), Pune, led by Dr A.F. Mascarenhas (other team members: Dr (Smt) R.S. Nadgauda and Smt V.A. Parasharami) devised a brew using the tissue culture method, that spurs young bamboo plants of three species to flower prematurely within a period of a few weeks, which under normal circumstances takes several years and not until the plants are 20 to 30 feet tall. This discovery has wide implications in supplementing its growing economic demands. It is a breakthrough that will have tremendous potential in the breeding of bamboo to fashion novel hybrids which will grow faster, resist diseases and yield



Inflorescence culture of bamboo



The team members (from left): Dr (Smt.) R.S. Nadgauda, Dr A.F. Mascarenhas and Smt. V.A. Parasharami (photograph: courtesy *Maharashtra Herald*)

a stronger and more versatile wood. With further refinements in the technique, it may be possible to obtain a perennial source of seed. One of the most important uses of this work will be in solving the mystery behind the unpredictable flowering behaviour of bamboo, by studying the events leading to flowering under controlled conditions. The findings have been reported in *Nature*, 344 (6264) 335, 1990.

The spontaneous excitement with which this discovery has been received can be gauged from the reactions of the world press. David Hanke, a botanist at the University of Cambridge, in the editorial of the same issue of *Nature* has described it as "a spectacular success for the breeding of bamboo, which is a breakthrough that could have real significance for a quarter of the world's population". *New York Times* and *The Times* (London) highlighted this report with the headlines, "Bamboo coaxed to flower in lab: Global Impact on the Crop is Seen", and "Bamboo blooming to save the panda", respectively. In addition, the press all over the world has hailed this discovery, and the leading world magazines have also carried reports on this finding.

In conclusion to quote David Hanke from the editorial of *Nature*, "The discovery of Nadgauda, Parasharami and Mascarenhas opens up endless possibilities for the High Emperor of all the Grasses". □

Instant On-line Access to International Databases

This service offers instant access to interactive mode of more than 320 databases, i.e. 175 million records through DIALOG On-line Information System in USA. The access is gained through DIAL-UP or TELEX. The Indian National Scientific Documentation Centre (INSDOC), New Delhi, has Network User Identities (NUIs) of GPSS (International Gateway Packet Switching Service) of Videsh Sanchar Nigam Ltd at Bombay PAD and Delhi PAD.

All major databases, like Chemical Abstracts, INSPEC, Compendex, Medline, BIOSIS Preview, Energyline, Enviroline, World Patent Index, Math Sci., Dialog Business Connection, Dialog Medical Connections, are available.

The online search facility is being extended to more international information retrieval systems like ESA-IRS (European Space Agency—Information Retrieval System), Frascatle, Italy. This additional facility is sought to provide cost-effective access to more S&T data.

The On-line Service includes: Retrospective Literature Searching, Selective Dissemination of Information (SDI), and Electronic Document Ordering of only retrieved references in On-Line Searchings.

Information can be supplied on : S&T literature, patents and trademarks, industrial and business aspects, market and products, and economic and financial aspects.

The search outputs are supplied the same day. About 100 searches have already been successfully processed. □

Electronic Mail and Scientific & Industrial Research Network (SIRNET)

'Electronic Mail' allows the scientists and technologists to exchange information over computer and communication networks through electronically created messages. The messages are stored in an electronic mailbox and the recipient has number of options with the messages: reading, deleting, printing, forwarding and editing. The security aspect is well taken care of.

The Indian National Scientific Documentation Centre (INSDOC), New Delhi, is available on ERNET (Education & Research Computer Network) mail node for electronic mail facility.

A computer communication network for CSIR laboratories, SIRNET, is being planned to be set up. SIRNET, in addition to acting as intracity node for Delhi based CSIR laboratories and intercity node for other CSIR laboratories, will also act as a gateway to ERNET and through ERNET, to international networks. Any subscriber of this node will be able to

reach out to all the CSIR laboratories, and anyone who has an electronic mail address anywhere in the world. The CSIR headquarters is linked to UNIX mailserver in INSDOC. Also, the institute has communication facilities with the users in USA and UK through UUNET, BITNET, CSNET, etc.

The SIRNET is envisaged to facilitate the file transfer and document distribution also. □

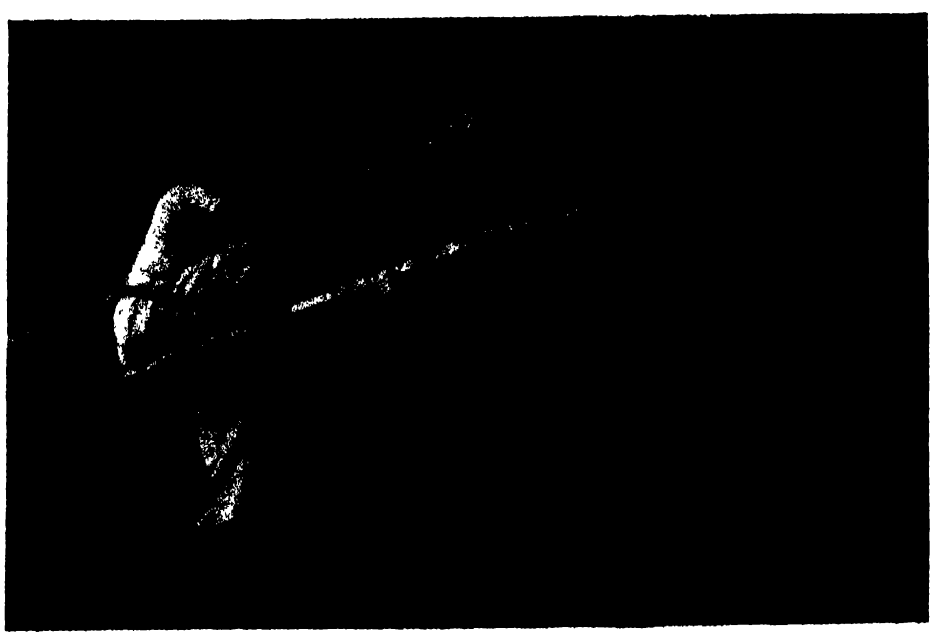
Lowcost Polymeric Systems for Building Industry

The polymeric systems are providing a wide range of substances of diverse applications and can be tailored to suit any particular requirement. One such use of these systems is in the form of adhesives for wood, PVC and cement and concrete, etc.

At present, the cost of polymeric systems using conventionally available thermosetting resins such as epoxy, polyester, polyurethane, phenol, formaldehyde, etc. is high, restricting their use in building industry. Studies on the development of lowcost polymeric systems, their characterization and industrial utilization, from the building industry point of view, has been carried out at the Central Building Research Institute (CBRI), Roorkee, by Shri K.K. Asthana in two parts.

The first part of the study deals with the synthesis of rubber modified cardanol polymeric system. For determining the rate of reaction of the synthesized resin with formaldehyde, reaction kinetics at the different temperature was studied. At 40°C, it followed the first order rate law till 65% of reaction, and at 50°C, till 55% of reaction. For studying the mode of reaction between cardanol and rubber, IR and NMR spectroscopic studies were conducted and it was concluded that –OH group of cardanol may be reacting with the available reacting sites of rubber.

Adhesives from the synthesized resins were developed For assessing the bonding characteristics of these adhesives with wood, concrete and PVC, rate of development of strength with time was measured at different humid and temperature conditions. Such studies were also conducted in case of the modified adhesives. It was found that in rubber-modified adhesives, the rate of development of strength is faster in comparison to unmodified adhesives. The modifed adhesives were found to have higher bond strength, superior moisture and boil water resistance too.



Joint filling with IPN putty: Vasai Creek Bridge

The second part of the study deals with the development of IPN-type epoxy phenolic polymeric systems and their characterization and utilization. A simultaneous inter-penetrating (SIPN) type polymeric system was synthesized. Mechanical properties, chemical properties, chemical resistance and morphology of the IPN system were studied and compared with that of the epoxy resin. These studies showed that IPN system has better bond strength with steel and concrete and superior compressive strength hardness, temperature resistance, etc. Chemical resistance against urea, diammonium phosphate, sulphuric acid, phosphoric acid, nitric acid, sodium hydroxide and distilled water was also evaluated up to a period of 270 days. It was concluded that IPN system possesses, better resistance than the epoxy resin.

Anti-corrosive paints for the protection of concrete and steel structures were formulated and evaluated in the laboratory as well as in the field conditions. A coating system for the protection of steel in RCC was also formulated and evaluated for its bond strength with the concrete, before and after subjecting to corrosion cycling test. Accelerated corrosion studies by weight change method and salt spray method were also conducted. The epoxy phenolic IPN coating performed very well even after 60 cycles of accelerated corrosion test.

The IPN coating has been used for protecting steel and concrete structures of the fertilizer plant of Juhari Agro, Goa, Vasai bridge super structure, Bombay, and at IFFCO, Phulpur, Allahabad.

Know-how for producing the IPN coating has been given to the following three parties for its commercial exploitation: Krishna Products, Bombay; Panchsheel Paints, Bombay; and Hari Om Construction & Waterproofing Co., Gandhi Nagar.

Shri Asthana, was awarded Ph.D. degree (Chemistry) bv the Kanpur University for his thesis based on the development of lowcost polymeric systems and their industrial utlization. He worked under the guidance of Dr R.K. Jain, Scientist Coordinator, Organic Building Material Section of CBRI. □

Pulsed Concentrated Solar Radiation (PCSR) for increasing Crop Productivity

Shri Sudhakar T. Zodape of the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, studied the eco-physiological aspects of cotton (*Gossypium hirsutum* L.). The study involved the exposure of seeds to PCSR as a presowing treatment, and its effect on germination, growth and yield of cotton. A solar seed irradiator was designed, fabricated and standardized at the institute for these studies.

The effect of PCSR on early seedling growth and biochemical changes of cotton was studied under laboratory conditions. The pot experiment studies were carried out to study the growth and yield of cotton as well as wheat. To achieve better results, certain necessary conditions were maintained, particulary moisture level, duration of irradiation and pulse rate.

Seeds generally contain proteins, starch and/or triglycerols as food reserve for germination. In the mobilization of these three reserves in germination they are hydrolyzed initially by protease, amylase and lipase. Higher level of amylase during germination and peak active period might be responsible for the hydrolysis of stored carbohydrates and the time of their rapid breakdown, and higher activity of protease might cause more/rapid hydrolysis of proteins to enable the seed germinate early and grow faster. Fat content in the seed is converted into fatty acids and glycerol by lipase and finally sucrose is released, which is further utilized to generate energy for the growth of embryo. In the present study higher activity of lipase was observed.

In addition, oxidizing enzymes, for example catalase and peroxidase, were estimated. These are responsible for the decomposition of hydrogen peroxide evolved during the auto-oxidation of some compounds which are toxic to the plants. The high levels of oxidizing enzymes, observed during the present study keep respiration rate high in order to produce the energy required for plant growth.

The study revealed that PCSR enhanced the germination. In general, high levels of enzymes and simultaneous synthesis of certain metabolites were observed under the influence of PCSR treatment. The increase in the cotton yield was to the tune of 8-10% over control. The increase in the yield as well as biomass (dry matter) was found to be directly proportional to the pulse rate per minute. Overall observations indicated that PCSR treatment at the rate of 300 pulses/min. for 10 minutes with 10% moisture level is significant for the production of more yield as well as biomass. The economics of the treatment was worked out. This indicated that the treatment is economically viable and useful for a country like India.

Shri Zodape was awarded Ph.D. degree by the Bhavnagar University for his thesis based on the above studies. He carried out the above work under the guidance of Dr V.D. Chauhan, Head, Marine Algae Discipline, CSMCRI. □

CSIR participates in International Spring Fair at Dubai

India, one of the first countries to recognize the industrial potential of UAE, improved its position from ninth in 1988 to seventh in 1989, as an exporter to Dubai. It exported goods worth Dh 1087 million to Dubai in 1989 as compared to Dh 809 million in 1988 (*Gulf News*, 2 March 1990). During the past 14 years, India-based companies have set up several joint ventures with UAE, related to civil engineering, rolling mills, gas cylinders, sulphuric acid, ice-cream plants and aluminium products. Many other projects are being planned, several involving non-resident Indian capital in UAE.

India participated in the Fifteenth International Spring Fair held in Dubai during 27 February-10 March 1990, with a contingent of 132 organizations/companies, making it the largest participant.

Participating for the first time in the fair, CSIR displayed its products and processes related to essential oils, fragrances, drugs, etc.

Three companies from UAE have initiated discussions to acquire technical knowhow from CSIR to extract oils from plants and roots for toiletories, foodstuffs and medicinal purposes. The companies are Gulf Atlas General Trading Establishment in Sharjah, Salah El din Mohammed Rashad of Sharjah and Maisaloon Trading Establishment of Abu Dhabi. These companies have also asked CSIR to provide knowhow for growing saline resistant plants such as palmarosa plants and lemongrass in UAE. Shri N. Sen, Adviser, (Planning), CSIR, who was present at the International Spring Fair said that there were encouraging enquiries from Spain and Iran as well as from companies from UAE (*Gulf News*, 12 March 1990).

Shri T.D. Nagpal, PRO, CSIR, said that a new anticholesterol drug gugulipid developed by CDRI, a CSIR laboratory, had been licensed to France, and negotiations were underway to license the NCL-developed catalyst to a firm in Holland. Last year, he said, CSIR gave two reverse osmosis desalination plants to Thailand. Also, CSIR received orders for

membranes for 20 plants. Of the 20 agrochemicals developed by CSIR, 15 are in production with an annual turnover of Rs 1 billion, Shri Nagpal said.

He said that 10 years back, India imported Rs 180 million worth of citronella oil, one of the ingredients used in the manufacture of soaps. Today, the country is producing Rs 1.2 billion worth of citronella oil every year, of which Rs 400 million worth of oil is exported (*Gulf News*, 12 March 1990). □

NEW PUBLICATIONS

Data Bank on Plastics in Buildings

Plastic industry is one of the fastest growing industries in India and is playing a vital role in the country's economy. Its dynamic and steady growth over the past two decades presents an impressive scenario. Today there are about 12,000 units netting an annual turnover of about Rs 35,000 million, adding an amount of Rs 12,000 million to the exchequer. About 40% of the total production is being accomplished in the small scale sector. With petrochemicals having been identified as thrust area in the Eighth Five Year Plan, plastics industry is expected to be on the threshold of further expansion, rapid growth and development.

About 20% of the total world production of plastics is estimated to be consumed by building and construction sector alone, where it has proved an economical and viable substitute for wood, steel, concrete and other conventional materials. Expecting a similar pattern of growth for polymeric building materials in this country and recognizing its high relevance in the building sector, National Standing Committee on Plastics in Buildings, constituted in May 1987, decided to set up a Data Bank-cum-Information Centre at the Central Building Research Institute (CBRI), Roorkee, for the guidance of the users, manufacturers and researchers. The Centre's main objective is to compile and collate production/consumption figures of different plastics building products, their applications in buildings, feed back on performance and cost benefit ratio vis-a-vis conventional building materials. An extensive literature survey was carried out, which included screening of published statistics of industrial houses on prices, availability of products and the consumption of raw materials. Various organizations, such as Indian Petrochemicals Corporation Ltd, Polyolefins Industries Ltd, National Organic Chemicals Industries Ltd, The Indian Paint Association, Indian Plastics Federation, PVC Pipes Development Organization, Bureau of Indian Standards and All India Plastics Manufacturers Association, were contacted to obtain the relevant information/data in their specific areas of operation. About 700 manufacturers were contacted for their manufacturing capabilities, product specifications, cost, etc. through structured questionnaire. Feed back information on performance of plastic products was collected from user departments, such as CPWD, State PWDs, HUDCO, NBO, Electricity Boards, Housing Boards and Defence Establishments. The information thus collected has been compiled in the title publication and classified under different heads. A general scenario, on use of Plastics in Buildings in India and abroad has been presented, followed by a separate section on comparison of properties with conventional building products. Information collected from manufacturers on different products and from user departments on performance has been grouped under two separate sections. The last section lists addresses of manufacturers of Polymeric Building Products in the country.

Enquiries pertaining to the publication (compiled and edited by R.K. Jain and B. Singh of CBRI) may be directed to: Director, CBRI, Roorkee 247667. □

CFTRI Monographs on Mango and Guava

The Central Food Technological Research Institute (CFTRI), Mysore, has recently brought out two monographs entitled: *Mango in India* and *Guava in India*. These monographs deal with production, preservation and processing aspects, covering distribution, varieties, propagation, harvesting, packaging and transportation, physico-chemical changes during development, pests and diseases, handling and storage, chemical composition and products. A comprehensive list of literature references and information on specifications for various products made from these fruits add to the usefulness of these publications. *Mango in India* has additional information on model schemes for processing, exporters of mangoes and suppliers of processing equipment and machinery. The price of *Mango in India* (pp 61) is Rs 50 and that of *Guava in India* (pp 36) is Rs 30 (postage extra).

Other monographs available in the series are: (1) Pineapple (Rs 15), (2) Pepper (Rs 15), (3) Papaya (Rs 20) (4) Grapes (Rs 20), (5) Banana (Rs 30) and (6) Mandarin Oranges (Rs 30).

For copies, please write to the Sales and Distribution Officer, FOSTIS, CFTRI, Mysore 570013. □

Honours & Awards

VASVIK Award (1988) for Dr A.F. Mascarenhas

Dr A.F. Mascarenhas, Scientist, Biochemical Sciences Division, National Chemical Laboratory (NCL), Pune, has been awarded the prestigious VASVIK Award for 1988, for his outstanding contributions to biological sciences. The award instituted by the Vividhlaxi Audyogik Samshodhan Vikas Kendra (VASVIK), Bombay, consists of a cash

prize of Rs 25,000, a gold medal and a citation.

The group led by Dr Mascarenhas has made significant contributions to tissue culture, notable amongst them being the tissue culture processes developed for isolation of virus-free sugarcane CO-740 and micropropagation of cardamom, which have been released for commercial exploitation.

Technologies have also been developed for teak, eucalyptus, turmeric and ginger. As a result of his initiative and commitment and also the pioneering role he played in transferring laboratory procedures to commercial applications, the tissue culture has developed into an industry in this country, with a sizeable annual production of tissue culture plants.

The Department of Biotechnology is establishing a Plant Tissue Culture Pilot Plant Facility at NCL, as a national facility. The objective of the pilot plant will be mainly to produce adequate number of tissue culture raised plants of some forest trees for field evaluation.

Dr Mascarenhas is a fellow of the Maharashtra Academy of Sciences and is a founder-member of the Plant Tissue Culture Association of India, holding the position of Secretary since its inception. He is co-ordinator of the joint programmes on forest biotechnology between India, Bulgaria and Wye College, UK. Dr Mascarenhas has published around 150 research papers and has edited two books. □

Dr Mohammad Athar gets UNESCO Young Scientists Award

Dr Mohammad Athar of the Industrial Toxicology Research Centre (ITRC), Lucknow, has won the 1989 UNESCO Young Scientists Award for his contribution in the field of toxicology. This award is given to young scientists below the age of 35 years of South East Asia for their outstanding contribution in the field of basic and applied sciences.

Dr Athar is working on the role of oxidative stress in the manifestation of toxicity of chemicals including metals. He has proposed a mechanism for the metal-mediated oxidative damage to biological system. In his recent work, he has tried to unravel the oxidative mechanism of skin photosen-

sitization by hematoporphyrin derivative, a known drug undergoing third phase trials for human use in the photodynamic therapy (PDT) of cancer. This work which he has done in animal model system if validated for humans may lead to the discovery of suitable therapeutic drug to reduce skin photosensitivity in the patients undergoing PDT. He has also tried to define the role of oxygen radicals in different stages of multiple step cutaneous chemical carcinogenesis. Using the electron spin trapping technique he has shown that human skin keratinocytes can metabolize organic hydroperoxides into free radicals. He has also shown that these compounds are effective stage-I and stage-II tumour promotors but are weak complete tumour promotors in mouse skin model system. Using various antioxidants and inhibitors, he has demonstrated the involvement of oxygen radicals in both stage I and II tumour promotion. Dr Athar has also shown that these hydroperoxides are potent progressors of benign tumours into carcinoma. Besides this, he has utilized his chemistry knowledge to design effective and selective chelating agents for the removal of nickel from the body organs of nickel-treated rats. He was Research Associate of the Department of Dermatology, Case Western Reserve University, Cleveland, Ohio, USA, for more than two years. Dr Athar has 75 publications to his credit, about 50 are full length manuscripts which include research papers, book chapters, reviews, etc. Based on his research career, he has been offered Associate Editorship for the journal *Synthesis and Reactivity in Inorganic and Metal-Organic Chemistry*, published from Marcel Dekker Press, USA. He has been elected as a full member of Society of Toxicology, USA. Also, he is a recipient of the 1988 Hoechst-Russel Research Award of the Dermatology Foundation, USA.

VASVIK Award (1988) for IICT Scientists

Dr U.T. Bhale Rao, Head, Organic Chemistry Division (leader), Dr Asad Ali Khan, Head, Chemical Engineering Division and Shri R.N. Parlikar, Head, Design and Engineering Division of the Institute of Chemical Technology, Hyderabad, have been awarded VASVIK Award 1988 for their contributions in the field of chemical sciences and technology.

P.K. Sarkar

Dr P.K. Sarkar, Scientist EII, Indian Institute of Chemical Biology, Calcutta, has been elected Fellow of the Indian Academy of Sciences. □

Appointments/Promotions

At the Indian Institute of Chemical Biology (IICB), Calcutta, the following personnel have been appointed with effect from the dates given in parentheses:

As Scientist EI
Dr Ashesh Nandy (8 March 1990)

As Scientist B [Grade-IV (1)]
Dr Ranjan Mukhopadhyay (20 Feb. 1990), Dr (Smt) Rukhsana Chowdhury (28 Feb. 1990) and Dr A.K. Banerjee (15 March 1990).

Also, the following have been promoted on assessment, as Technical Officers C: Shri S.K. Banerjee and Shri Sukdev Mandal (both from 24 Feb. 1986) and Shri A.K. Bose (30 Oct. 1987) (since retired). □

Transfers

Shri B.R. Channan

Shri B.R. Channan has joined the Publications & Information Directorate, New Delhi, as Controller of Administration (w.e.f. 17 April 1990), on transfer from the Regional Research Laboratory, Bhopal. □

Retirements

Shri M.L. Kachroo

Shri M.L. Kachroo, Scientist EI, Indian National Scientific Documentation Centre, New Delhi, retired on 28 February 1990. □

PATENTS FILED

1235/DEL/89: An improved process for the preparation of 2,3,6-trimethyl phenol, K.V. Ramanamurty, G.S. Salvapati, M. Janardanarao, Y.V. Subbarao—Indian Institute of Chemical Technology, Hyderabad.

1236/DEL/89: A process for the production of kiln car deck slab and other kiln furniture, S.K. Guha and A.D. Gupta—Central Glass & Ceramic Research Institute, Calcutta.

1237/DEL/89: An improved glass composition for fabrication of *p*H glass electrodes using the said composition, S.K. Guha, A.P. Bhattacharjee and J. Chakraborty—Central Glass & Ceramic Research Institute, Calcutta.

1238/DEL/89: Resistor composition useful to form a resistor element and a resistor so formed, S.K. Guha, M. Saha and N. Halder—Central Glass & Ceramic Research Institute, Calcutta.

1239/DEL/89: A process for the preparation of novel bioxyanion catalysts useful for the preparation of polycarbonates and a process for the preparation of polycarbonates using the said catalysts, S. Sivaram, J.C. Sehra and V.S. Iyer—National Chemical Laboratory, Pune.

1240/DEL/89: A process for the production of bricks, A.C. Khazanchi, S.R. Karade and C.B. Raju—Regional Research Laboratory, Bhopal.

1241/DEL/89: A process for the preparation of roof and wall covering from natural fibre reinforced red mud, fly ash in polymer matrix, A.C. Khazanchi, M.K. Patel and M. Saxena—Regional Research Laboratory, Bhopal.

1242/DEL/89: An improved process for the treatment of plant materials for making them useful as reinforcement in matrices clay/cement/polymer, M. Saxena, R.K. Morchhale, A.C. Khazanchi—Regional Research Laboratory, Bhopal.

1243/DEL/89: A process for the preparation of polymeric fatty complexes in emulsion form for use as syntan in post tanning operations in leather industry, S.S. Rajadurai, K.K.G.A. Dev, V. Haribabu and P. Krishnaiah—Central Leather Research Institute, Madras.

1251/DEL/89: A process for the improvement and modification of wasteland and desert soils from thermal power plants waste fly ash, for conversion into productive land mass, A.C. Khazanchi, A. Chauhan, S. Sethi and T.C. Rao—Regional Research Laboratory, Bhopal.

1252/DEL/89: An improved electroplating bath and a process for the preparation of a metalloid amorphous coated mild steel using the said bath, D. Mukherjee and C. Rajagopal—Central Electrochemical Research Institute, Karaikudi.

1253/DEL/89: An improved process for the preparation of dental amalgam alloy, P. Basak and R. Dubey—National Metallurgical Laboratory, Jamshedpur.

1254/DEL/89: A process for recovery of gold from dross generated during gold refining through a cyanide free route, D.S.C. Murthy, M. Dey and D.D. Akerkar—National Metallurgical Laboratory, Jamshedpur.

1255/DEL/89: A process for preparation of pharmaceutical composition with enhanced activity for the treatment of hypertension angina pectoris, ischaemic heart diseases and hyperthyroidism, Usha Zutshi, K.L. Bedi, R.K. Johri, S.C. Sharma, J.L. Kaul, M.K. Tickoo, Rajender Gupta and Gulshan Bano—Regional Research Laboratory, Jammu.

1256/DEL/89: A process for the preparation of a new binder useful for the construction of roads and for the formation of surfaces of airfields, S. Bose and P.K. Jain—Central Road Research Institute, New Delhi.

1257/DEL/89: A process for the preparation of an inhibitor suitable for protection of equipment used in the production of edible oil from rice bran, Inder Singh, K.P. Mukherjee—National Metallurgical Laboratory, Jamshedpur. □

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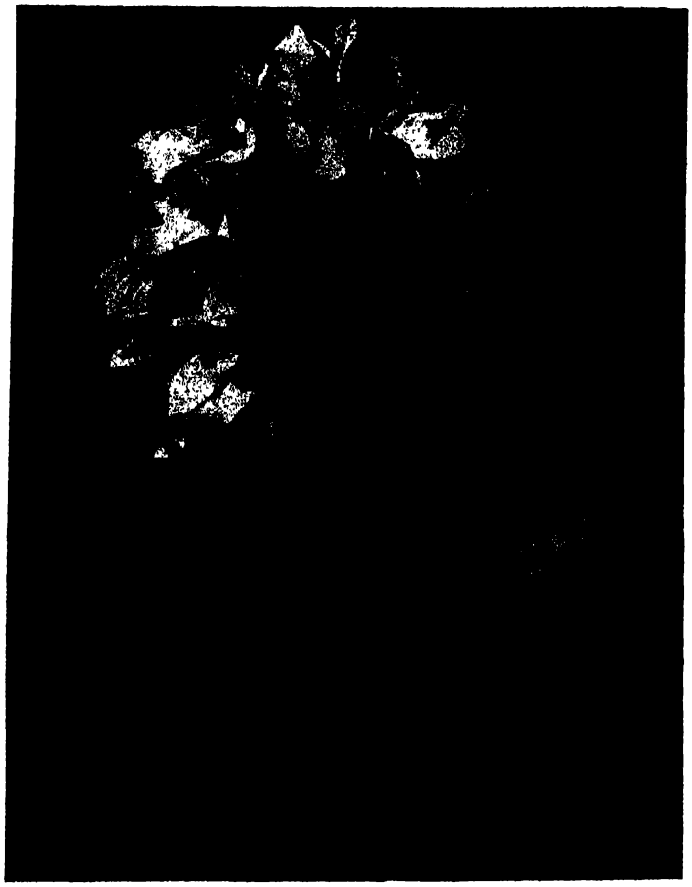

Two varieties of Bougainvillea: Chitra (left) and 'Hawain Beauty' (right) developed by NBRI, Lucknow. A report on floriculture research at the institute appears on p. 118.

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Workshop on Futurology at RRL-Jammu

A Workshop on Futurology was held at the Regional Research Laboratory (RRL), Jammu, during 2-4 April 1990, under the sponsorship of the Department of Science and Technology. Aspects covered by the workshop were: Future research methodologies; Techniques to develop regional long range plan perspectives incorporating emerging science and technology; and Strategies to manage issues arising from technology society nexus. The main objective of the workshop was to promote awareness and importance of future forecasting and provide a brain storming platform to understand future problems, threats, likely solutions and opportunities for wider dissemination. More than 35 delegates representing R&D institutions, universities, colleges, development banks and government departments participated in the workshop.

Inaugurating the workshop, Prof. M.L. Lakhanpal, Vice Chancellor of the Jammu University, cautioned about some of the dangers of newer and high technologies. Citing the example of green revolution which resulted in more food production, he mentioned about the large amounts of pesticides used, the toxic effects of which we do not know clearly. He was critical of a technologist who wastes enormous resources in the name of keeping pace with advanced technology. He said that our world needs less pollution which has already exceeded the limits.

Dr R.S. Kapil, Director, RRL, Jammu, in his welcome address gave a brief account of the RRL activities and contributions made during the last few decades. He mentioned the importance of futurology and technology forecasting. He cautioned against the dangers of excessive exploitation of our resources.

Prof. Vinayshil Gautam of IIT, Delhi, also addressed the audience during the inaugural session and later, presented a paper on Forecasting of Training Needs and Training as An Instrument, in the first technical session. Dr J.S. Chawla, Programme Coordinator, presented a background paper on Futurology—Technology, Management, and Society. He emphasized the need for efficient and dedicated managers who can take care of future threats and opportunities for the well being of society. Twenty-nine papers were presented in all, covering various aspects of Futurology, such as management, planning, manpower, education, technology, population, industry and research methodologies.

Delegates from different faculties of the Jammu University, Sher-e-Kashmir University of Agriculture Science and Technology and RRL, Jammu, actively participated by presenting papers and in the discussions during the three-day workshop. Delegates from IDBI, National Bank for Agriculture and Rural Development and Institute of Applied Manpower Research also presented papers and took part in the deliberations.

Following recommendations emerged from the deliberations of the workshop:

1. Subject of futurology be introduced in the curriculum of Indian universities at various levels, i.e. undergraduate and post-graduate. Training and orientation programmes for existing manpower should be organized.

2. Awareness regarding futurology must be created among the intelligentsia of the country by means of workshops/conferences concerning futurology; important subjects be identified and specialized futurology programmes be offered. Adequate material should be made available for wide dissemination of knowledge concerning futurology, making use of audiovisual aids. If possible, national media be involved in this exercise.

3. Appropriate technologies be evolved to develop substitutes and alternatives to fulfil the gap keeping in view the stress on land. Biotechnology has a leading role to play in the future in providing alternative sources of food, and improvement of life by way of genetic manipulation. This area of research needs further encouragement.

4. The subject of futurology needs an extensive financial support; the Department of Science and Technology should provide liberal funds for encouraging research in this area.

5. Human Resources Ministry be contacted to include the area of futurology for manpower development. Also, assessment and forecasting of manpower requirements in emerging areas be considered for planning based upon analysis supported database.

6. A system of reciprocal design be created in which engineers, scientists and ecologists work together for harmonious coupling of the urban, industrial and life support system.

7. A society on futurology be formed in which experts from different disciplines may cooperate to evolve suitable system of dissemination of knowledge. Clubs in the colleges and universities and community be started for creating mass awareness.

8. Keeping in view all these factors it was suggested that a database be set up to answer information regarding: (i) Availability of different categories of technical personnel on the basis of existing intake/out turn relationship at the national and state levels, (ii) Requirement of different categories of technical manpower at the national and state levels, (iii) Expected gaps in demand for and supply of such personnel during the next ten years, (iv) Absorption pattern of different categories of technical manpower into economic activities, (v) Need for expansion/curtailment in the facilities of education/training for specific categories of technical manpower. □

First National Congress on Metallic Corrosion

The First National Congress on Metallic Corrosion was organized on 1 March 1990 by the National Corrosion Council of India (NCCI) in collaboration with the Society for the Advancement of Electrochemical Science & Technology, at the Central Electrochemical Research Institute (CECRI), Karaikudi. The congress was attended by about 200 delegates from all parts of the country. The technical programme consisted of invited lectures and poster sessions. The congress was presided over by Prof. S.K. Rangarajan, Director, CECRI and Patron, NCCI and inaugurated by Prof. K.I. Vasu, President, SAEST and former Director, CECRI.

Seven invited lectures on the recent developments in the field of corrosion and its prevention, three case studies from fertilizer and space industries and a lecture on corrosion audit, were delivered by experts in their respective fields. The lecture on corrosion audit highlighted the losses owing to corrosion and stressed the need for the conjoint action by all concerned to contain corrosion to a minimum. In addition to these invited lectures there was a poster session in which 23 papers were displayed and discussed.

During this congress, the second meeting of the NCCI was also held and members representing various private, government and public sector undertakings discussed aspects related to promotion of awareness in the field of corrosion control and the measures to be taken therefor. The decisions/recommendations of the NCCI meeting are as follows:

1. The third meeting of NCCI will be held during May/June 1990 in Delhi with the participation of important government officials from the ministries concerned, to impress upon the need for recognizing corrosion research as one of the national thrust areas of research and for making adequate budget provision in the Eighth Plan, for corrosion research in India.

2. The Council also decided to approach the Planning Commission for financial help for setting up a Corrosion Testing Facility Centre at CECRI, Karaikudi.

3. The Council recommended that a Corrosion Map of India should be prepared with the help and participation of government agencies/public sector undertakings, academic and research institutions and data should be collected on: (i) Atmospheric corrosion, (ii) Underground corrosion/soil corrosion, (iii) Corrosion by inland waters and (iv) Corrosion and fouling in coastal waters.

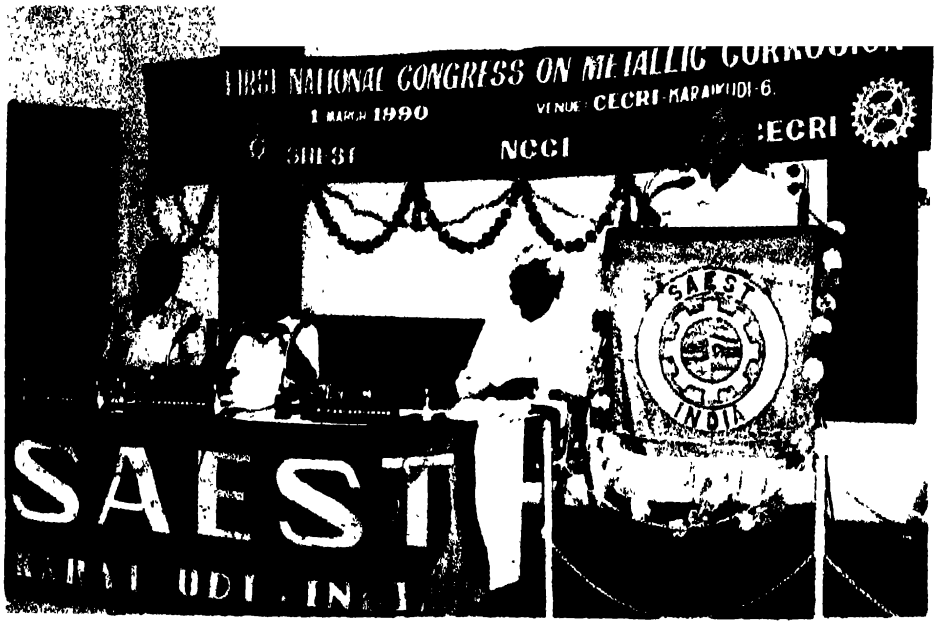
4. The Council decided to set up task forces for the various methods of corrosion control. These task forces will put forward their recommendations to the Council for initiating relevant R&D in these fields.

5. NCCI also recommended to bring out a monthly Corrosion News Letter for effective dissemination of knowledge in the field.

6. A database would be set up by CECRI, Karaikudi, for transferring information on materials performance and corrosion control to industries and other agencies.

7. Corrosion audit should be made mandatory for all the major industries.

8. The Second National Conference on Metallic Corrosion will be held at Bangalore in May/September 1991. □



Prof. S.K. Rangarajan, Director, CECRI, Karaikudi, delivering the presidential address at the First National Congress on Metallic Corrosion

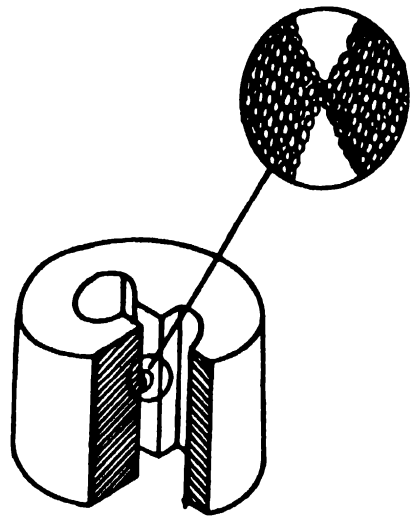
Demonstration SQUID based on High Temperature Superconductor

Superconducting Quantum Interference Device (SQUID) has unsurpassed sensitivity for sensing magnetic field. This device is atleast thousand times more sensitive than the best conventional non superconducting device, i.e. flux gate magnetometer. It consists of either one or two Josephson junctions in a superconducting ring (Josephson junction has two superconductors separated by a thin insulating layer).

SQUIDs based on low temperature superconductors have been used in a variety of applications such as detection of small magnetic fields associated with heart and brain, prospecting of oil and minerals, non destructive testing of cracks inside the body of ferromagnetic materials and ultralow frequency communication between a submarine and the ground base. However, most of these applications could not reach commercial level owing to the very low temperature [obtained by cooling with liquid helium (4.2K)] involved in the operation of these devices. The liquid helium is not easily available besides being costly and difficult to manage.

With the discovery of high temperature superconductors in 1987, attempts are being made all over the world to demonstrate the applicability of this remarkable discovery in various fields. One such attempt has been to develop a SQUID which operates at liquid nitrogen temperature (77K) which is easily available.

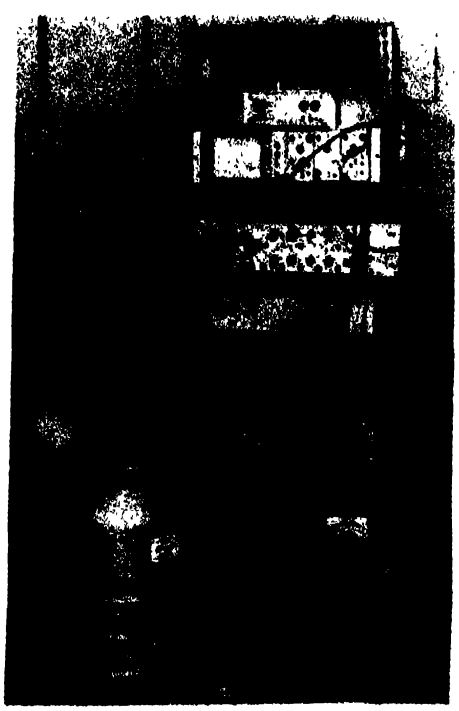
In India, CSIR took up this challenge and in January 1989 an inter-laboratory programme was initiated to develop a demonstration SQUID device by the end of March 1990. Four laboratories of CSIR, namely Central Electronics Engineering Research Institute (CEERI), Pilani; Central Glass & Ceramic Research Institute (CGCRI), Calcutta; National Physical Laboratory (NPL), New Delhi and the Regional Research Laboratory (RRL), Trivandrum, were entrusted with this task, with Dr A.K. Gupta, Scientist, NPL, as the coordinator.



Schematic diagram of the rf SQUID using grain boundary Josephson junctions

Earlier work at NPL and at other laboratories abroad has already established that the high temperature superconductors are granular in nature and the superconducting grains provide natural Josephson junctions at the grain boundaries. Thus a bulk superconductor consists of a large number of Josephson junctions. These inherently present Josephson junctions have been exploited in the present work to make a SQUID device which operates at liquid nitrogen temperature (77K).

The SQUID developed by CSIR laboratories operates at about 20 MHz and has sensitivity of the order of 3×10^{-4} $\Phi_0/\sqrt{Hz}$ above 100 Hz. Φ_0 is the flux quantum (h/2e) and its value is 2.07×10^{-7} gauss cm^2 □



Experimental set-up used for characterization of rf SQUID

Utilization of Fly Ash for Development of Wall Tiles, Acid and Abrasion Resistant Tiles and Stoneware Sewer Pipes

The use of fly ash for making pozzolanic cement, cement concrete, bricks, light weight synthetic aggregates and in the construction of roads and pavements is well known. The Central Glass & Ceramic Research Institute, Calcutta, has investigated the possibility of utilization of fly ash for making wall tiles, acid and abrasion resistant tiles and sewer pipes; these studies are presented here:

Wall Tiles

Fly ash, plastic clay, feldspar and talc were used for body preparation. Red lead, zircon, Rajmahal clay, barium carbonate, whiting, borax and boric acid, etc. were the raw materials for the glaze. The fly ash, collected from a local power station had the following composition (%): SiO_2–52.36, Al_2O_3–18.27, Fe_2O_3–12.68, TiO_2–1.47, CaO–2.16, MgO–1.09, K_2O–1.57, Na_2O–0.22, L.O.I.–9.40.

The crystalline phases in fly ash as observed by X-ray and DTA measurements were mainly free quartz, mullite, haematite and magnetite. The sieve analysis of the fly ash is given in Table 1. Several compositions were tried for wall tiles. The batch compositions were wet mixed in a pot or ball mill. Water of the body was removed by plaster of Paris moulds and sun drying. The body was sieved and the tiles were pressed in a hand operated toggle or hydraulic press under a pressure of 10,000 psi (700 kg/cm^2).

Table 1

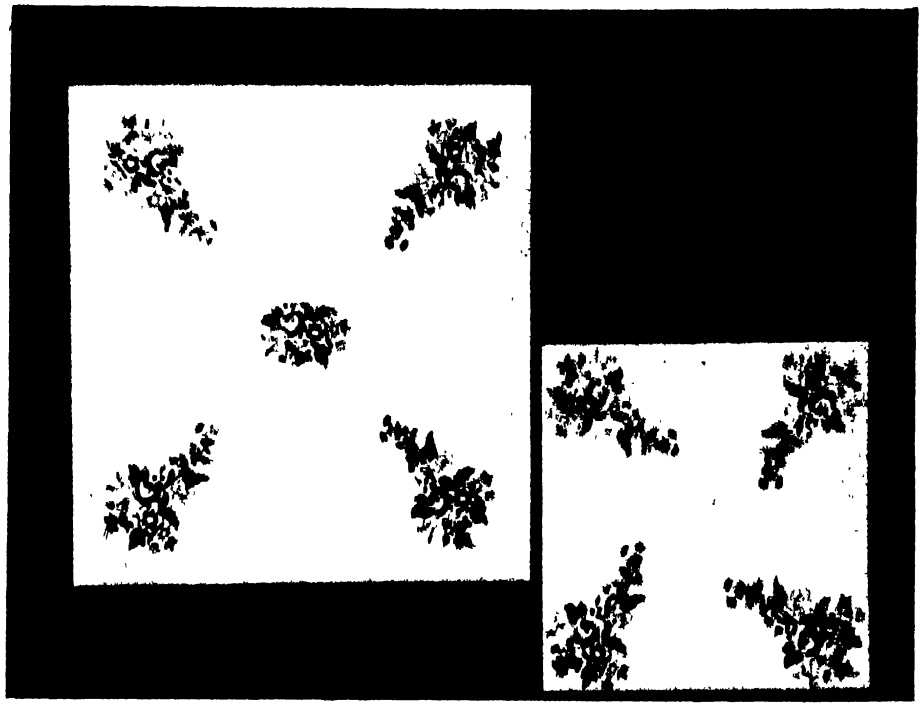
Sieve analysis of fly ash (total weight taken 100g)

	Sieve size (microns)	Fraction retained (g)
Above	423	0.15
"	300	0.07
"	212	0.84
"	150	0.80
"	106	12.71
"	75	8.49
"	53	14.59
"	45	18.10
Below "	45	41.55

The dried tiles were biscuit fired at 1050–1150°C and glazed at 850–950°C in an electric furnace. The lead fritted glaze maturing at 900°C was developed in this laboratory for wall tile body.

For fritting, the batch was fired in 5 lbs refractory crucible in an oil fired furnace at about 1300°C. The frit was mixed with china clay and was ground in pot mill. The sieved ground material was mixed with water to have glaze of prescribed specific gravity. The glaze was applied on the surface of the biscuited tile and fired.

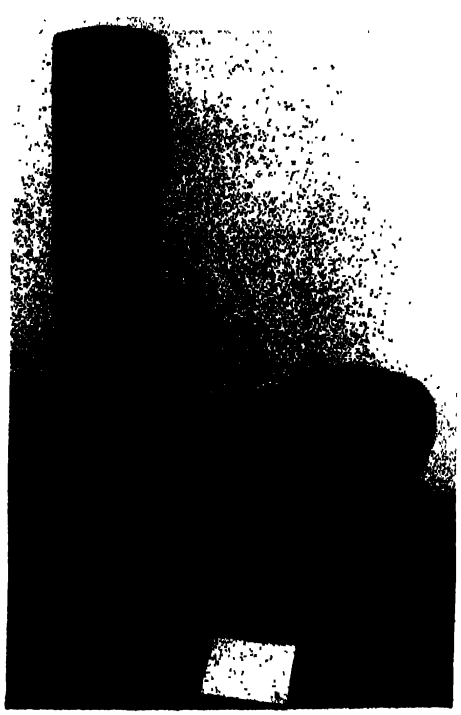
The tiles conform to IS: 777 and may be used like glazed earthen ware tiles on the walls of bathrooms, kitchens and underground subways, etc. where cleanliness is important. Sometimes these tiles are also used on the floor of water closets.



Wall tiles from fly ash

Abrasion and Acid Resistant Tiles

The usual raw materials for acid resistant tiles are clay, feldspar quartz and talc. In the CGCRI studies, fly ash was used as a major raw material (50%) along with plastic clay, feldspar, talc and also small amount of zircon sand.



Salt glazed sewerage pipes and tiles from fly ash

The body compositions of unglazed vitrified acid and abrasion resistant tiles were dry or wet mixed in a pot or ball mill. The body prepared by wet mixing was found to be superior. It was slip cast and thereafter dried in the sun. The dried body containing 6–10% moisture was granulated by passing through 10 mesh sieve and the tiles were pressed in a toggle or hydraulic press.

The wet mixed body was filter pressed and sun dried to reduce the moisture content up to 7-10%. The granulated body was pressed in semi-automatic press. Pressed tiles were fired in tunnel or shuttle kiln either in saggers or in the open furnace. Some tiles were also fired in coal fired down draft kiln. In laboratory trials, the pressed tiles were fired in electric furnace at temperature depending on the composition.

The tiles fired in electrical furnace were grey coloured and presented smooth surface on polishing. In plant trials when tiles were fired in stack in saggers, black coring was observed due to the presence of carbon and iron in the fly ash and partial reducing atmosphere. Incomplete oxidation of carbon caused black core to develop. When tiles were fired in a single layer in a kiln so that the entire surface of the tiles was exposed to air, no black coring was observed. These tiles meet the IS specification 4457 for acid resistant test. The abrasion loss of the tile fired in the laboratory was found to be 0.66 ml/h as comparison to 1.51–0.72 ml/h observed in the case of the same type of commercially available vitrified tiles. These vitreous acid resistant tiles can be used in the floors and tank lining to resist corrosion of chemicals acidic in nature. As these are abrasion resistant, these may also be used in coal washeries as clinker tiles and other industrial floors which are likely to be damaged by abrasion.

Sewerage Pipes

The usual raw material for making pipes is clay or a mixture of clays which fuses at about 1200°C. A red clay with fly ash was used; the chemical composition (%) of the clay was:

Table 2

Comparative study of performance of wall tiles made from flyash and as required by IS 777

Properties	Wall tiles made from fly ash	Performance required as per IS 777
Water absorption	14%	Shall not exceed 18%
Crazing	After undergoing two cycles at constant steam pressure of 7.5 ± 0.2 kgf/cm^2 in an autoclave for one hour each did not show any sign of crazing.	After undergoing two cycles of steam pressure 7.5 ± 0.2 kgf/cm^2 in an autoclave as described in the method given in IS 777 should not show sign of crazing.
Impact strength	0.02 kgfm/cm, determined by pendulum apparatus (as described in IS 777, 1970).	Tiles when tested for impact strength as described in IS 777 shall not have value less than 0.02 kgfm. cm.
Chemical resistance	When tested by the method described in IS 777 the glazed surface of the tiles having white colour did not show deterioration after immersion in 3% HCl or in 3% KOH for 7 days.	When tested for chemical resistance by the method described in IS 777, shall show no deterioration in glaze.

Table 3

Comparative study of the performance of acid and abrasion resistant tiles with the performance as specified in IS 4457

Properties	Performance of acid and abrasion resistant tiles made from fly ash	Performance required as per IS specification
Water absorption	Less than 1%	As per IS 4457 the amount of water absorption shall not exceed two per cent.
Resistance to acid	Loss in weight when determined according to IS 4457 was 1.4%.	As per IS 4457 loss in weight shall not exceed 1.5%.
Compressive strength	Compressive strength was not determined [MOR (Average) 726 kg/cm^2.]	Compressive strength 700 kg/cm^2 as per IS 4457.
Abrasion resistant property	Abrasion loss when done according to IS 2839 0.66 ml/h.	In the IS specification there is no mention of abrasion loss. Abrasion loss of vitrified tiles of some Indian manufacturers varies from 1.51 ml/h to 0.72 ml/h.

SiO_2–55.70, Al_2O_3–20.76, Fe_2O_3–6.37, TiO_2–2.10, CaO–2.77, MgO–1.03, K_2O–0.90, Na_2O–0.22 and LOI–9.92.

Powdered grog was also added to the body for reducing the shrinkage and improving the drying and firing properties. The amount and grain size of the grog was varied with the diameter of the pipe. Waste broken pipes were used as grog.

In laboratory scale investigation, samples were made by hand throwing and were dried and fired. Pipes were made in usual way, these were salt glazed at vitrification temperature of 1150–1200°C to complete the reaction.

The samples passed IS specification of 1600 kgf/m in respect of crushing strength and were impervious.

The main raw material, fly ash, is available in most parts of the country in abundance. Its chemical composition may vary slightly depending upon the quality of coal used. This variation may be adjusted in the body composition by changing the proportion of other ingredients added.

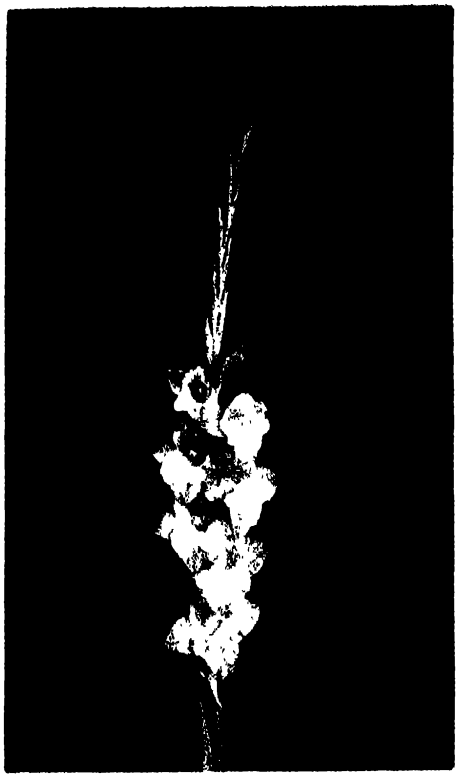
Incorporation of locally available fly ash in wall tiles will save cost on raw materials. The firing temperature is almost same or slightly lower than the firing temperature of tiles made from conventional raw materials, which may result in energy saving. Abrasion resistant property of these tiles is better than some vitrified tiles commercially available. Considering the huge requirements of the drain pipe making industry, incorporation of fly ash, an industrial waste, in the body will make substantial savings towards cost of materials in the pipe manufacturing units. □

Floriculture at NBRI

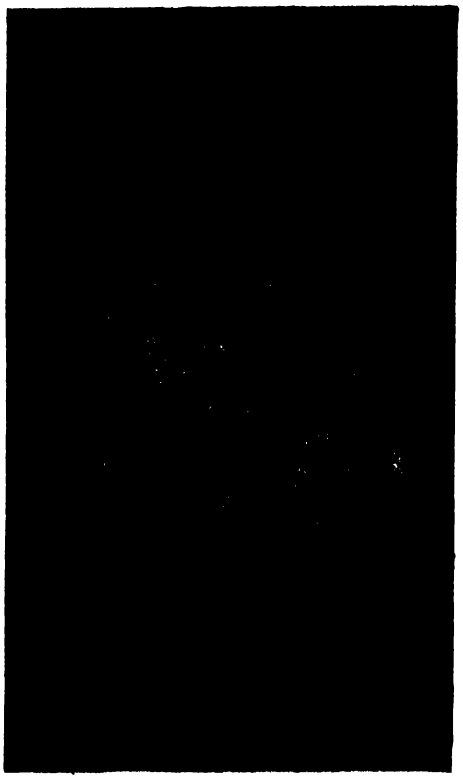
B.P. SINGH, S.C. SHARMA AND M.A. KHER
National Botanical Research Institute, Lucknow

The project 'Improvement, Protection and Standardization of Agrotechniques of Ornamental Plants for Nursery and Cut Flower Trade,' being actively pursued at the National Botanical Research Institute (NBRI), Lucknow, aims at the building up of the germplasm with wide genetic base; improvement of ornamentals for national and international trade, development of agrotechniques suitable for introduced/acclimatized and improved material, and studies on post harvest physiology, based on the multi-disciplinary approach. In the past few years, studies at NBRI have been primarily confined to Chrysanthemum, Gladiolus, Bougainvillea,

Gladiolus 'Sadabahar' (tropical cultivar)



Gladiolus 'Sanyukta' (tropical cultivar)



Chrysanthemum 'Kundan'

Amaranthus, Gerbera, Canna, and Rose.

I. Building up of Broad Genetic Base

A broad genetic base is the first pre-requisite for any fruitful basic or applied research work on plants. Intensive efforts in this direction have now yielded a repository of living collection of important ornamentals, viz. Amaranthus (300 accessions), Amaryllis (6 spp./56 cvs.), Bougainvillea (200 spp./cvs.), Canna (100 cvs.), Chrysanthemum (400 cvs.), Gladiolus (80 cvs.) and Rose (500 cvs.).

For avoiding confusion in the nomenclature of the cultivars, authentic identification, classification and their usage in floriculture and landscaping, horto-taxonomical studies on Chrysanthemum, Gladiolus and Bougainvillea have been taken up.

II. Improvements in Ornamentals

Qualitative upgrading, creation of novelty in colour/form and extending the blooming period, are the three directions in which the efforts have been focussed under this project. Several new cutlivars have been developed through mutation, selection, hybridization and polyploidy.

III. Agrotechniques

Agrotechniques specifying nutritional, water and interculture requirements have been standardized for Gladiolus, Chrysanthemum and Bougainvillea. Several exotic and novel training methods for large and small flowered Chrysanthemum have been standardized to obtain giant (20 cm across) to mini (1.5 cm across) flowers on potted plants trained in highly artistic styles.

A large number of garden enthusiasts have been trained in these methods through several courses conducted at NBRI during the past few years.

IV. Protection

Seroindexing of Gladiolus and Chrysanthemum for plant viruses and viroids is the routine activity to weed out virus-infected plants and to produce virus-free plants. The virologists are using biological indexing, ELISA immunobinding and PAGE electrophoresis depending upon pathogen and its concentration.

Various cultivars of Chrysanthemum are susceptible to diseases like wilt, blight, leaf spot and floret rot. Corm rot is a common disease of Gladiolus corms during storage. Efforts have been made to control these diseases by manipulating weed and vector population, using fungicides, insecticides and growing virus free plantlets *in vitro* for virus-free propagules.

V. Physiological studies

Physiological studies have been made to overcome the dormancy in Gladiolus using 20 ppm benzyl aminopurine (BAP) and induce flowering in under size corms or cormels with the help of 10 ppm ascorbic acid. BAP (20 ppm) breaks the apical dominance and results in multiple sprouts of Gladiolus. Studies on the response of Chrysanthemum varieties

Crop	Name of cultivar	Method
1. *Chrysanthemum* — Cutflower	Birbal Sahni, Apsara, Jaya, Jayanti, Jubilee, Kundan, Shyamal	Selection
	Agnishikha, Alankar, Himani, Kumkum, Manbhawan, Navneet, Pitamber, Purnima, Shabnam, Sheela	Mutation
—Dwarf plant (no pinch no stake)	Guldasta, Hemant Singar, Sharad Singar, Suhag Singar	Selection
— Season of Blooming		
Early blooming: (One month before normal season i.e. in October)	Ajaya, Sharad Mala	
— Late blooming: (One month after normal season, i.e. in January)	Vasantika and Jaya	
— Hot weather blooming: (summer and rainy season)	Himanshu, Jwala, Jyoti, Meghdoot	
2. *Gladiolus*	Jwala, Kalima, Sadabahar, Smita	Selection
	Archana , Arun, Kajal, Kohra, Hans, Indrani, Manhar, Manisha, Manmohan, Manohar, Mohini, Mridula, Mukta, Pitambar, Sanyukta and Triloki	Hybridization
3. *Bougainvillea*	Shubhra, Archana, Manohar, Chandra Variegata, Parthasarthy, Surekha, Shweta, Hawain Beauty	Mutation (Bud sport)
	Begum Sikandar, Chitra, Mary Palmer Special, Wajid Ali Shah,	Hybridization
	Arjuna, Pallavi	Mutation
4. *Amaranthus*		
— Inflorescence	Amarshola	Hybridization
— Ornamental foliage	Amar Jyoti, Amar Mosaic, Amar Parivarti, Amar Peet, Amar Prithu, Amar Raktaabh, Amar Suikiran, Amar Tarang, Amar Tetra	Colchiploidy
5. *Amaryllis*	Kiran, Samrat, Jyoti	Hybridization
6. Rose	Salmon Beauty, Winter Holiday Clg CriCri, Sharada, Sukumari, Tangerine Contempo, Pink Contempo, Yellow Contempo, Twinkle	Mutation (Bud sport)

The above new cultivars have been propagated for mass multiplication using different methods of propagation including tissue culture.

to photoperiod have yielded useful information which can be readily utilized for commercial production of Chrysanthemum on predetermined dates at will.

Studies on opening of flower buds by keeping the bud-cut sprays in holding solution, standardized at the institute, have also resulted in useful knowledge that can be fruitfully applied by florists.

TAB Project

In view of the emergence of floriculture as an important industry both at national and international levels, NBRI has initiated a collaborative programme with the CSIR Complex at Palampur, with a view to making available the planting material and a package of cultivation and post harvest techniques to the entrepreneurs for catering to the local outside market in the hills and plains. At present, the programme is confined to Gladiolus and Chrysanthemum, both of which are likely to yield better economic returns.

A model plan has been worked out providing all the details of bed size, planting distance, manurial and irrigation requirements, harvesting, packing and storage of corms for Gladiolus cultivation in the north Indian plains by planting cultivars such as Aldebaran, Friendship, Eurovision, Red Beauty, White Goddess, besides NBRI hybrids Archana and Arun, suitable for promoting cut-flower trade. Many florists have taken up Gladiolus cultivation on commercial scale utilizing plant material, and R&D expertise of NBRI.

NBRI also organizes Annual Chrysanthemum & Coleus and Rose & Gladiolus shows to expose institute's R&D work on these crops and to inculcate the interest in floriculture among nurserymen. Also, the institute has published a bulletin on Gladiolus.

Participation of CSIR Scientists in First Indian Scientific Expedition to Weddel Sea, Western Antarctica

Two scientists, Dr V. Divakara Rao and Shri Shikar Chand Jain of the National Geophysical Research Institute, Hyderabad, participated in the prestigious and adventurous first Indian Scientific Expedition to Weddel Sea, Western Antarctica (78°S latitude and 49°W longitude). Dr Rao is a Geochemist and Shri Jain a Geophysicist. The expedition consisted of six scientists, three from the Geological Survey of India, one from the Oil & Natural Gas Commission, apart from the two CSIR scientists. During the expedition, the scientists carried out reconnaissance survey of the Filchner shelf and Berkner island. Unlike the east Antarctica, the west is more dangerous and access to Weddel Sea is limited to short periods during summer that too once in few years. □

Dr A.P.J. Abdul Kalam delivers Foundation Day Lecture at IICT-Hyderabad

Dr A.P.J. Abdul Kalam, Director, Defence Research and Development Laboratory (DRDL), Hyderabad, delivered the 10th Foundation Day Lecture of the Indian Institute of Chemical Technology (IICT), Hyderabad, instituted in honour of its Founder Director Dr S. Husain Zaheer, on 28 February 1990. The topic of the lecture was: Advances in Aerospace Technology.

Introducing the illustrious speaker, Dr A.V. Rama Rao, Director, IICT, said that, as a Project Director of SLV-3, India's first Satellite Launch Vehicle, Dr Kalam was responsible for carrying out the design, development, qualification and flight testing of the 44 major sub-systems in achieving this goal. For the mission, he brought together nearly 10,000 engineers and technicians from multiple technology centres for the development of rocket motors, composite products, control, guidance and electronics integration, check out and launch. Later on, he pioneered the Integrated Guided Missile Development Programme, establishing indigenous capability for the country in surface to surface and surface to air (third generation) missiles, and anti-tank missile systems. The Government of India has recognized his services by awarding him Padma Bhushan in 1981 and Padma Vibhushan in 1989. In addition, he has got several prestigious awards like National Design Award for Engineers (Institution of Engineers), Dr Veerendra's Space Award (Aeronautical Society) and Om Prakash Bhasin Award in Science and Technology.

In his lecture, Dr Kalam discussed in detail the aerospace technology in four parts: Propulsion technology, Composite materials and products, Area of sensors and Improvement in the satellite payload capability for a given take-off weight. In addition, he highlighted the country's integrated guided missile development programme.

In the propulsion system, Dr Kalam explained with the help of slides and graphs, India's position vis-a-vis other advanced countries of the world. He said that there seems to be a limit as far as the solid propulsion systems based on binders and oxidisers are concerned. So, to increase the efficiency, liquid propulsion systems, i.e. liquid oxygen, liquid hydrogen, are being used in the Indian Space Research Organisation. This way we can get 50% more energy. However, DRDO has already developed integrated *Ram* Rocket, solid system for one of its projects *Aakash*—surface to air missile. Here magnesium-based fuel rich propellant, with limited oxidisers, is used. This system will be tested in flying in a few months time.

Dr A.P.J. Abdul Kalam delivering the Foundation Day Lecture at IICT, Hyderabad

On 22 May 1989, *Agni*, a reentry technology vehicle, was launched by the country. This vehicle on reaching 80 km achieves a velocity of 3-4 km per second. At this stage, temperature at the tip of missile is around 3000°C, but inside we keep it around 40°C. The heat shield is achieved using composites and carbon-carbon material. In the third generation anti-tank missile *Nag*, 70% of the structure is made of carbon composites or glass composites.

Sensors constitute a very crucial high technology area for the missile programme. When a surface-surface missile like *Prithvi* is launched, we need sensors technology for finding out the deviation of the flight path and feeding the control system for mid-course correction. We have to develop a lot in this area, concurrent development and production is going on and some of the academic institutions are paticipating.

Regarding improvement in the satellite payload capability for a given take-off weight, a lot is being done. At present only 3% of the payload can be put in the lower orbit, i.e. with 100 tonnes per take-off weight only 3 tonnes can be put in the lower orbit. The first European attempts have proved that 5% of the payload can be put in the lower orbit, while NASA, USA, has claimed to send 10% of the load in the lower orbit. Our Indian study, multiple institutions

joining together, is attempting a 15% payload in the lower orbit. We have used a new concept in this field and our experience in the missile programme has proved that there exists scientific and technological strength in most of the field. If our laboratories, industry and academic institutions work together, we can bring miracles in this field, Dr Kalam claimed.

A question and answer session followed Dr Kalam's lecture. Dr U.T. Bhalerao, Scientist G and Head, Organic Chemistry II Division, proposed a vote of thanks.

Dr Kalam also visited the bio-organic laboratory of the institute and was acquainted with the work going on in the institute. □

Dr A.P. Mitra visits RRL-Jorhat

Dr A.P. Mitra, Director General, CSIR, visited the Regional Research Laboratory (RRL), Jorhat, on 9 February 1990. Dr Mitra also visited oating areas of Golaghat District to see the citronella plantation of M/s Jallan Enterprises and also to meet some of the essential oil growers of Assam. In their meeting with the CSIR Director General, the growers commented that Jor Lab C-2 has proved to be superior to other strains of Java citronella in terms of oil production. Dr Mitra expressed his happiness over the practise of using the spent-up grass as fuel for the distillation unit, in addition to its use in mulching. Steps have been taken by the Jorhat laboratory to install central distillation units in the remote areas of Karbi Anglong, where villagers can bring and sell the citronella grass. In Karni Anglong itself some 250 families are working in this essential oil industry, and more families are expected to join in this venture in future. Dr J.N. Baruah, Director, RRL-Jorhat, pointed out that the impact of this industry is very much felt in upper Assam areas and some pockets of lower Assam where more than 18,000 people are engaged in citronella cultivation, producing about 380 tonnes of oil per annum.

Dr Mitra advised the scientists to keep a link with the growers and to develop high yielding strains of Java citronella suitable for agro-climatic condition of North Eastern Region. □

Dr A.P. Mitra visiting citronella field near Golaghat

Prof. A. Lapidus of IOC, USSR, visits CFRI

Prof. A. Lapidus, Head, Laboratory of Catalytic Reactions of Carbon Oxides Institute of Organic Chemistry (IOC), Moscow, USSR, visited the Central Fuel Research Institute (CFRI), Dhanbad, from 21 to 26 March 1990, primarily to discuss about the progress made in the field of FT synthesis at CFRI and in USSR laboratories. Prof. Lapidus is the Russian Coordinator of the continuing INDO-USSR cooperation programme in the area of catalysis.

Prof. Lapidus also had discussions relating to partial oxidation of methane to methanol and formaldehyde, synthesis of chemicals from byproducts of coal carbonization, synthesis of olefin from syngas, activation of carbon dioxide for fine chemicals and researches on C_1-chemistry. □

PROGRESS REPORTS

NGRI Annual Report: 1988-89

The major areas of research at the National Geophysical Research Institute (NGRI), Hyderabad, relate to studies of the lithosphere, of environment including physics of earthquake processes and the dynamic hydrological regime, and development of evermore penetrating exploration technologies. According to the annual report of NGRI for 1988-89, brought out recently, the new emphasis of R&D of the institute would be on the design of synergistic approaches, and on evaluating the quality of inference.

New initiatives taken during the year to develop the areas of Geomechanics and Mineral Physics would add further substance to these endeavours by providing additional dimensions to the models of lithospheric processes as would the seven extramural R&D groups formed to create high level transdisciplinary capabilities around the new powerful

computer system (CYBER 850A), in the seminal areas of Signal Processing, Image Processing and Pattern Recognition, Artificial Intelligence and Expert Systems, Inversion and Experiment Design, Seismic Modelling, Hydrological Modelling, Graphics and Geophysical Knowledge Technology.

Geophysical exploration for locating fresh water in problem villages of the country continued to be a major programme of the institute. Over 600 geoelectrical soundings were made during the year in various parts of Rajasthan, Orissa, Karnataka, Andhra Pradesh, Meghalaya and Jammu & Kashmir. Fifty-five deep electrical soundings complemented by 80 line km of magnetic and resistivity profiling were carried out in the Barmer district of Rajasthan to locate deep fresh water aquifers. Most of the 128 wells, drilled on the strength of geophysical indications, produced fresh water. One of these located in an otherwise saline environment proved to be especially prolific, yielding over 50 klph of potable water. To date, 1124 potential drill sites have been located for drinking water in 923 villages spread over 11 districts, using geophysical technology; 90% of the wells so far drilled have yielded potable water even in areas where blind drilling had earlier produced dry holes.

For rapid analysis and interpretation of electrical sounding data in terms of a layered earth, a versatile and flexible general purpose computer software was designed for use on a wide range of computer systems and PCs. A number of engineers and technologists from different parts of the country engaged in groundwater exploration were trained in the use of this software.

Modelling of the shallow and deep structure of the crust in the Cambay basin using signal amplitudes, revealed the presence of a thick sedimentary layer under the traps as well as a high velocity layer (7.3 km/s) at a depth of about 23-25 km. The Moho in the basin was found to be at a depth of 31-33 km.

Reinterpretation of older DSS data in Koyna and along the various profiles traversing the Son-Narmada Lineament, after digitization brought out the existence of alternating high and low velocity layers below the Moho.

The first wide band magnetotelluric exploration made in the Saurashtra basin early in 1989, clearly showed the existence of sediments beneath the basalt cover whose thickness varies from about a kilometre in the south to about a hundred metres further south of Chotila. The MT data also indicated that this part of the lithosphere has high resistivity.

Delay time tomography using teleseismic P-wave residuals revealed the existence of an anomalously high velocity upper mantle (1-6% contrast) beneath the whole of the South Indian shield and a relatively low velocity (1-5% contrast) under the western and north western parts of Deccan traps. These results together with an analysis of ϵ_{Nd} ratios of basalts along the Carlsberg ridge, point to the source of Deccan basalts in the still warm remanent of the rift that separated India from Madagascar (80 Ma), while the Indian continental lithosphere has deep roots (300 km) that translate coherently with it.

An important middle Proterozoic tectonic event marked by a 300 km long dyke (1900 Ma) cutting the Dharwar craton in the N-S direction was delineated using high precision Sr isotopic measurements on separated mineral phases.

Another important tectonic event of crustal reactivation associated with the Pan-African event was similarly discovered in the Shivamalai alkaline rocks (623 11 Ma) just south of the Moyar-Bhavani shear zone.

A stress map of the Indian continent and adjoining oceans showing orientations of the maximum horizontal compressive stress was prepared by analyzing data from the wellbore breakouts of several deep (1-4 km) wells drilled by ONGC, as well *in-situ* stress measurements by hydraulic fracturing and well constrained earthquake focal mechanisms. The map provides the first consolidated picture of the stress field over the Indian continent to serve as a constraint for modelling its geodynamic processes.

During the year, 56 papers and 35 technical reports pertaining to sponsored research, computer software and other specific investigations, were published. □

INSDOC Annual Report: 1988-89

The Indian National Scientific Documentation Centre (INSDOC), New Delhi, has brought out its annual report for 1988-89. According to the report the main emphasis of the institute continued to be to provide information support to S&T community in the country. The services provided by INSDOC fall under five major groups: Document copy supply, Translation service, Bibliographic information, Reprography service and Printing. The Printing Unit (now transferred to Publications & Information Directorate, New Delhi) showed increased productivity and the translation section cleared a large number of back-logged orders.

A National Centre on Bibliometrics (NCB) was established during the year. Compilation of the research output of CSIR laboratories for 1987 and that of a six volume publication entitled 'In Search of Knowledge: CSIR Contribution', were taken up and completed. The hard labour of INSDOC for more than a decade culminated in the compilation of National Union Catalogue of Scientific Serials in India (NUCSSI); it was released on the CSIR Foundation Day (26 September 1988). NUCSSI consists of 4 volumes and contains holding data of more than 800 S&T libraries of the country. The database has been created on magtape and efforts were being made to make it on-line.

INSDOC conducted short-term training courses in bibliometrics and

computer applications, in which about 50 candidates were trained. A seminar on 'Learned Periodical Publications in India' was organized in collaboration with Asiatic Society of India. Another significant event of the year was the selection of INSDOC as a national focal point for SAARC Documentation Centre Also, INSDOC started a training-cum-collaboration programme with National Technical Information Services (NTIS) of USA. □

Children meet Scientists at RRL-Jorhat

The Regional Research Laboratory (RRL), Jorhat, organized a 'Children Meet Scientists' programme on 27 March 1990 in which some 95 science students of higher secondary level participated. The students were shown a number of scientific experiments. Popular talks were arranged on low-cost building materials, drinking water and on India's ocean resources. Video show on achievements and activities of the laboratory and a science quiz contest session were also organized.

The programme started with the inaugural function, where Dr D.C. Goswami, Coordinator of the programme, explained the objectives. Dr B.K. Saikia, Deputy Director, in his presidential address spoke on the activities and achievements of the laboratory and welcomed the participants to take advantage of such programmes.

The programme was sponsored by the National Council of Educational Research and Training, New Delhi, as a part of the National Science Day celebration. □

PATENTS FILED

122/DEL/90: A device for measuring vertical gradient of roads and other plane surfaces, M.P. Dhir, P.S.K.M. Rao, Y.C. Tewari, R.P. Sarin, K.S. Kapoor, Y.R. Phull, R. Gupta and S.K. Gupta—Central Road Research Institute, New Delhi.

NEW PUBLICATIONS

Industrial Monographs on Tropical Fruits Released

The Central Food Technological Research Institute (CFTRI), Mysore, has brought out six industrial monographs covering the production, preservation and processing of Mango, Mandarin, Orange, Banana, Grapes, Pineapple and Guava.

The monographs were released by Prof. M.M. Chakraborty, Chairman, Research Council of CFTRI, on 23 February. Lauding the CFTRI efforts, Prof. Chakraborty mentioned that these monographs would be invaluable to the industrialists, entrepreneurs, agricultural universities, promotional agencies and others, Dr J.V. Shankar, Area Coordinator, Technical Publication Division, CFTRI, explained the objectives of the publications activity and said that this programme had the benefit of partial fiscal support of the All India Food Preservers' Association. The first publication entitled 'Traditional Foods: Some Products and Technologies' was brought out by CFTRI in 1986. The current programmes include compilation of monographs on production and post-harvest technology of Litchi and Chillies, besides the 12th revised edition of the book entitled *Homescale Preservation and Processing of Fruits and Vegetables.* □

Honours & Awards

Dr M.S. Thakur

Dr M.S. Thakur, Scientist, Central Food Technological Research Institute (CFTRI), Mysore, was awarded the Biotechnology Overseas Associateship for 1988-90 by the Department of Biotechnology, Government of India, to work on the on-line monitoring of fermentation processes using Biosensors, in USA. After working with Prof. D.I.C. Wang at the Massachusetts Institute of Technology, for one year, he is now at the University of Maryland, Baltimore, with Prof. D.I.C. Wang and Dr G. Rao. □

PERSONNEL NEWS

Appointments/Promotions

At the Publications & Information Directorate (PID), New Delhi, the following personnel have been promoted on assessment with effect from the dates given in parentheses:

As Scientists EI
Smt S.P. Mehta (24 March 1987), Dr B.C. Sharma (17 Sep. 1987) and Shri M.L. Sharma (25 July 1987)

As Editor C
Shri J.N.P. Sinha (17 July 1984)

As Sales & Dist. Officer C
Shri G.E. Salpekar (18 June 1981, since retired)

As Senior Sales & Dist. Officer
Shri D.S. Bhatnagar (1 June 1976, since retired)

As Art Officer C
Shri N.A. Sukhapure (15 May 1988, since retired)

As Art Officer B
Shri K.N. Gambhir (20 June 1986)

As Production Officer B
Shri Kaushal Kishore (15 Dec. 1988).

At the Indian Institute of Chemical Biology (IICB), Calcutta, the following personnel have been appointed with effect from the dates given in parentheses:

As Scientist B [Grade IV(1)]
Dr (Smt) Padma Das (30 March 1990)

As Technical Officer B [Grade III(4)]
Km. Krishna Das (31 Aug. 1989), and Smt Shila Elizabeth Besra (26 March 1990).

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CSIR NEWS

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Indian henbane (*Hyoscyamus niger*) var. *Aela* developed by CIMAP, Lucknow. A report on Genetic and Plant Breeding Research at CIMAP, appears on p. 129

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CDRI celebrates Its Thirty-ninth Annual Day

The Central Drug Research Institute (CDRI), Lucknow, celebrated its thirty-ninth Annual Day on 17 February 1990.

Highlighting the activities of CDRI at a function held on the occasion, CDRI Director Prof. B.N. Dhawan said that the major area of activity of the institute was development of new drugs, immunoprophylactics and immunodiagnostic agents. The projects in this area operated in a mission mode manner with continuous monitoring of the progress and regular in-house review followed by reviews by the Research Council and the CSIR Technical Advisory Board for Biological Sciences wherever necessary. He expressed satisfaction that the projected milestones had been achieved in most cases.

Enumerating the achievements of his institute Prof. Dhawan said that further improvements had been made in filariasis diagnostic kit and the licencee, M/s Malladi Drugs and Pharmaceuticals Ltd, Madras, was present on the occasion to commercially launch the kit. Gugulipid had continued to capture an increasing share of the Indian market and CDRI had signed an agreement with the French firm, Arkopharma Laboratories, Nice, France, for introducing it initially in France, followed by its introduction in other EEC countries. Prof. Dhawan said that in addition to a premium of about $ 2,20,000 the institute will earn royalty for seven years on net sale in all those countries.

As regards the progress of work on drugs in advance stages of development, Prof. Dhawan informed that phase IV clinicial trials of the anti-thyroid drug Centimizone and extended phase III clinical trials of Centchroman, including regular ultrasonographic and laboratory monitoring of the volunteers in six medical colleges of the state, had progressed satisfactorily. The multicentric trials of Centchroman to evaluate its efficacy in advanced breast cancer had been progressing at five centres and was to be shortly initiated at one more centre. Phase II clinical trials had been completed successfully with the antidepressant Centpropazine and the neuromuscular blocking agent Chandonium iodide and data submitted to the Drugs Controller. Permission for phase III trials with Centpropazine had been obtained and the studies initiated. An agreement had been signed with Ranbaxy Laboratories for commercialization of Chandonium iodide.

About the drugs in early stages of clinical trials, Prof. Dhawan mentioned that phase I studies with the hypolipidaemic agent 80/574 were nearing completion. Single dose studies had been completed with the anti-relapse antimalarial compound 80/53 and the antimalarial arteether derived from artemisinin. Both have shown excellent tolerance.

About compounds under preclinical development, Prof. Dhawan said that studies had been completed with the hepatoprotective Picroliv from *Picrorhiza kurroa*, a new anti-allergic compound 73/602, the *M. habana* vaccine for leprosy and the broad spectrum anthelmintic 81/470. Drugs Controller's permission was awaited for initiating clinical studies. Safety evaluation of several compounds including Bacosides (which improve learning and memory), rifampicin depot preparation and the hemostatic tamarind seed polyose had been completed. A number of new leads identified and being vigorously pursued include an antiviral compound isolated from marine alga *Ulva fasciata*, a hypoglycemic compound from *Aplysia benedictii* and antileishmanial compounds from seeds of *Nyctanthes arbortristis*, the common Har-singar plant. Another compound (85/83) was being developed as a potential menses inducer with a novel mechanism of action.

Speaking about the industrial use of institute's processes, Prof. Dhawan said that the technologies transferred to the industry continued to perform well. Wockhardt Ltd, Bombay had not only met the total national need but also exported 25 tonnes of the potent analgesic dextropropoxyphene

Prof. B.N. Dhawan delivering his address during Thirty-ninth Annual Day celebration of CDRI

to 11 countries including USA, UK, Germany, France and Canada. Several industrial concerns were desirous of acquiring CDRI technologies for ephedrine and clofazimine which had already been successfully commercialized. Significant improvements had been made in technologies for Centchroman and Centbutindole and negotiations for licensing the former to IDPL were being finalized. A process for production of Bacampicillin had been successfully developed and transferred to Wockhardt Ltd. New processes had been developed for Mefloquin and Ibuprofen. Three novel methods of peptide synthesis had been developed including the use of 3-hydroxypropionitrile as a reagent for carboxyl protection.

Large scale field trials had been undertaken at several places in the country in collaboration with the Malaria Research Centre on biocide formulation of *B. sphaericus* and the results were being analyzed. The biocide had been shown to maintain efficacy over periods of several weeks. A more virulent strain of *B. sphaericus* was being developed further.

Prof. Dhawan said that the 22 KD surface protein isolated in the previous year from *Vibrio cholerae* had shown good protection against experimental cholera in rabbits and hoped that it would be fused with the B subunit to develop a synthetic vaccine. Significant protection had been obtained with interferons in a number of fungal infections in addition to potentiation of the antifungal drugs thus reducing their toxicity.

In the field of basic studies, a new pro-aggregatory factor, which is a low molecular weight protein, had been isolated from the blood and was being characterized. The factor is expected to provide an important new site of action for anti-thrombotic drugs and could be useful in conditions like myocardial infraction. Also,anti-oxidant enzymes and polyamine uptake mechanism of filarial parasites had been identified as important biochemical targets for drug action and were being developed as new test systems. Studies on the RBC membrane had shown the importance of amino-phospholipid pump in the maintenance of the membrane asymmetry in addition to the generally accepted role of the cytoskeleton. Test systems had been standardized to evaluate drug effects on ionic channels in the myocardium in view of therapeutic potential of agents affecting calcium, potassium and sodium channels.

As regards efforts to sharpen the focus of R&D activity during the Eighth Plan to achieve better results, Prof. Dhawan said that about one-third of the current projects were in the process of being phased out. Work in a new area, Chemistry and Biology of Peptides, had been initiated and was expected to lead to the development of new analgesics, antidiabetics and other categories of drugs, new immunomodulators and synthetic antigens. A nucleus for the parasite bank had been created and plans were in the process of being finalized for work on Protein Engineering and Centralised Tissue Culture Facilities.

The institute continued to maintain effective collaborative links with several research and academic organizations/agencies in the country and abroad. Projects funded by the national agencies like Ministry of Health, ICMR, DBT, DST, etc., were being pursued in addition to several projects under the integrated long term programme for S&T cooperation with USSR, bilateral programmes with USA, including the Vaccine Action Programme and schemes under the US-India funds, West Germany and Thailand. CDRI had been recognized as one of the four laboratories by the Department of Biotechnology for Indo-US projects under the programme covering Contraceptive Development and Research in Immunology. During the year, a number of eminent scientists visited the institute under bilateral programmes of CSIR, INSA and DBT, TOKTEN programmes, etc. providing opportunities for mutual discussion and development of collaborative programmes.

Reporting on the progress made by national level facilities existing at the institute, Prof. Dhawan said that the National Laboratory Animal Centre, supported by DBT; Regional Sophisticated Instrumentation Centre, supported by DST, National Information Centre for Drugs and Pharmaceuticals, supported by DSIR had continued to provide satisfactory services to the research organizations, academies and the Indian drug industry. The NICDAP had been identified by DBT as a part of the Biotechnology Information System (BTIS) Network. The ICMR Centre for Advanced Pharmacological Research on Traditional Remedies had obtained several useful leads for hepatoprotective, antifilarial, macrofilaricidal and anti-allergic agents from the drugs used in traditional systems of medicine besides developing Quality Control parameters for Kshar-sutra used for non-surgical treatment of anal fistula.

Prof. Dhawan thanked the Director General of Health and Family Welfare, U.P., for his help and collaboration in clinical studies of Centchroman and other CDRI drugs. He said that in order to further facilitate such studies in rural settings, a CDRI Centre had been jointly established at Tilhar in Shahjahanpur District.

The institute continued to provide valuable inputs for training and manpower development in various areas of drug research. Besides Indian scientists, a number of trainees from Nepal, Thailand, Vietnam, Afghanistan, Pakistan and Norway were sponsored by international agencies. A practice school for final year students of BITS, Pilani, was initiated enabling them to spend six months on research projects in CDRI laboratories. Under a summer training programme, selected B.Sc. III year and M.Sc. II year students of the Lucknow University were paid stipends to work in CDRI laboratories for three months.

An International Symposium on 'Natural and Synthetic Drugs' was held on 10-11 February and three brain storming workshops were organized in collaboration with the Department of Ocean Development to develop a long-term national perspective on drugs and biochemicals from the Indian Ocean. Prof. B.K. Bachhawat delivered a lecture on Liposome Technology under the CSIR distinguished lecture scheme on 18 October 1989.

During the year, the external cash flow had risen significantly, crossing the Rs 30 million mark. This is more than 33% of institute's budget, well above the average of CSIR laboratories. There was significant funding to a project on Cholera under the Indo-US VAP programme, a $ 100,000 contract for preclinical evaluation of antimalarial drugs and a West German contract for DM 50,000 for safety evaluation of a new antileprosy agent. The CDRI Director added that while all efforts were being made to increase institute's external cash flow, significant additional funds would be needed from CSIR or other national agencies for major facilities to be created during the coming years, including a high/medium voltage electron microscope, a new infectious disease block in the animal house, the parasite bank and the protein engineering group. Prof. Dhawan also emphasized the necessity to procure land and construct some laboratories to reduce pressure on the historical Chattar Manzil Palace in which the institute is housed.

During the year, several CDRI scientists received prestigious awards: Dr Madhu Dikshit, the INSA Young Scientist Award and Achari Prize of the Indian Pharmacological Society; Drs S.K. Chatterjee, M.C. Bhatia and V.C. Vora, the Vasvik Award; Dr C.M. Gupta, the Nitya Nand Endowment Lecture Award of Indian National Science Academy, Prof B.N. Dhawan, the Ranbaxy Research Foundation Award, Fellowships of the National Academy of Science and the National Academy of Indian Medicine and invited annual oration of the College of Allergy and Immunology. Many research fellows and staff members obtained Ph.D. degree from Indian universities and about 210 research papers had been communicated to national and international journals and 10 patents filed. CDRI papers continued to figure prominently among the most cited CSIR publications.

About the efforts to keep the public well informed of the institute's progress, the institute organized open house and exhibition to mark the CSIR Foundation Day on 26 September and the National Science Day on 28 February. The institute also participated in national exhibitions at Gauriganj in UP and Ottapalum in Kerala.

Concluding the report, Prof. Dhawan re-affirmed institute's total commitment to effectively fulfil whatever demands arise for the national health care needs. He expressed hope for a more productive collaboration with the industry, the research agencies and academic institutions.

Prof. Dhawan's speech was followed by the Annual Day address by Prof. B. Ramamurti, Head, Department of Neurosurgery, V.H.S. Medical College, Madras. Expressing concern over the medical education in the country, Prof. Ramamurti said that it had failed to produce new ideas. He said that medical research had not received due importance though government funds were available in plenty whenever approached with feasible proposals. Analyzing the causes of these negative trends Prof. Ramamurti added that doctors were lured to private practice due to better financial gains, and called for better salaries and perks to researchers. Prof. P.N. Tandon, gave away mementoes to institute employees who had completed 25 years of service in CDRI. Complimenting the institute staff, he said that the CDRI had come a long way and was doing excellent research work in the field of new drug development. Prof. S.C. Bhattacharya, Ex-Director, Bose Institute, Calcutta, while delivering the presidential address emphasized on the need for raising the quality of scientific research in India from mediocre to outstanding level.

The occasion was also marked by the release of Filariasis Diagnostic Kit (FST) by Malladi Drugs & Pharmaceuticals Ltd, Madras to Dr S.C. Bhalla, Director General, Medical & Health Services and Family Welfare, U.P. Speaking on this occasion, Dr Bhalla said that the FST was the result of high quality work done by CDRI, and hoped that it would serve as a useful tool in early detection of filariasis. He pointed out that a large number of people in Uttar Pradesh were suffering from filariasis and that a filariasis detection centre was proposed to be setup in Jaunpur for the benefit of rural population.

Dr S.K. Basu, Deputy Director, CDRI and Chairman, Organizing Committee, proposed a vote of thanks. □

Caribbean Oceanographic Resources Exploration Project Launched

One of the major international collaborative project in the area of S&T taken up by CSIR and the Commonwealth Science Council, the Caribbean Oceanographic Resources Exploration (CORE) project was launched by the Commonwealth Secretary General, Dr S. Ramphal and the CSIR Director General, Dr A.P. Mitra on 12 April at Kingston, Jamaica, by flagging off R V *Sagar Kanya* on a 45 day cruise of the Caribbean waters, for multidisciplinary ocean survey. The project was taken up after discussion between Dr G. Thyagarajan, Secretary, CSC and Dr Mitra, and is largely funded

by the Government of India, Commonwealth Fund for Technical Cooperation (CFTC) and Caribbean countries. It has support of CARICOM. The thirteen participating Caribbean countries are Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Monsterrat, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Trinidad and Tobago.

In the first stage, 22 scientists from Caribbean countries, of whom three were women, were given three months training during October-December 1989 at the National Institute of Oceanography (NIO), Goa, covering theoretical, laboratory and shipboard training in marine survey & equipment, sampling, data collection and analysis, marine instrumentation, remote sensing and hydrography.

The Caribbean survey will cover living and non-living resources such as fisheries, biomass, minerals, and energy. The project proposes to establish pollution models and ocean circulation patterns in the region with the aim of helping the countries to exploit their ocean resources for scientific and economic development. The data will be compiled, processed and analyzed at NIO, in which Caribbean scientists will also participate.

Estimated to cost $1 million, the CORE project has Indian contribution ~ 36%, CFTC's contribution ~ 26%, the Caribbean countries contribution ~ 23%, with the Science Council meeting the rest. □

Genetics and Plant Breeding Research at CIMAP

J.R. SHARMA
Division of Genetics & Plant Breeding
Central Institute of Medicinal and Aromatic Plants, Lucknow

Medicinal and Aromatic (M&A) plants constitute the most viable alternative cash crops for growers, and are virtually goldmines for pharmaceutical and essential oil industries. As such, they afford to be a powerful supplement to agrarian reforms and economic emancipation of the rural masses on one hand, and of industrial growth and the enhanced prospects of national export, on the other. However, owing to erratic and frequently poor production, a 'boom and bust' cycle of industrial production for the phytoproducts based on M&A plants is often encountered. Notwithstanding the state of plenty in respect of a remarkably wide variety of flora and fauna, M&A plants being the most preponderant, that India is blessed with, the production very often suffers from uncertainty with sagging trends. This, ostensibly inflicts the interest of both growers and industries alike. The chief cause of poor yield leading to stark vulnerability of industries underlies the fact that in majority of cases the raw material or the grist for these industries is provided by wild growing M&A plants with no uniform quality and productivity. To meet the demands of industry, it is therefore necessary to develop superior varieties of these plants, which will have uniform quality and productivity, through genetic manipulation.

The concerted efforts of a group of devoted scientists (Geneticists/Breeders) at the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow and its Regional Centres at Bangalore, Bonera (Srinagar) and Kodaikanal, over the years, have led to the development and subsequent release of several superior cultivars of medicinal and aromatic plants for commercial cultivation. The salient attainments of the institute's applied as well as basic research are presented here:

Applied Research: Improved Varieties Released for Users

The continuing efforts towards genetic improvement of M&A plants have resulted in the release of superior varieties and their subsequent graduation to commercial cultivation by users.

Shyma (opium poppy)

A. MEDICINAL PLANTS

Plants studied for genetic manipulation include those used widely in pharmaceutical industries producing drugs against cancer, malaria, cough, intestinal disorders, pain, etc. The eight new varieties of medicinal plants developed and hitherto released are listed in Table 1 and described here for each crop:

(a) Opium poppy (*Papaver somniferum*) is source of opium and opium alkaloids, like morphine, codeine, thebaine and papaverine. The two new varieties evolved are: **Shyama** (1984)—originated from half sib family selection, gives 83% more latex (with 15% morphine strength) than the commercial check in vogue. **Shweta** (1984): emanated from HS family selection, yields 56% more

Table 1: Improved varieties of medicinal plants released for commercial cultivation

	Improved var.	Crop	Year of release	Biomass (q/ha)	Crude drug yield (kg/ha)	Chemical constituent	
						Name	%
1.	*Shyama*	*P. somniferum*	1984	—	78.0 (42.0)	Morphine	15.0 (11.0)
2.	*Shweta*	*P. somniferum*	1984	—	66.0 (42.0)	Morphine	18.0 (11.0)
3.	*Asha*	*A. annua*	1988	29.0 (18.0)	3.2 (1.5)	Artemisinin	0.11 (0.08)
4.	*Aela*	*H. niger*	1987	73.0 (50.0)	23.0 (11.0)	Crude drug	0.318 (0.211)
5.	*NP-41*	*H. muticus*	1985	32.0 (31.0)	37.0 (26.0)	Crude drug	1.40 (0.84)
6.	*HMT-1*	*H. muticus*	1986	43.2 (37.7)	45.0 (33.0)	Crude drug	1.05 (0.87)
7.	*Hansa*	*C. cinarariefolium*	1985	20.6 (8.5)	28.0 (10.0)	Pyrethrins	1.30 (1.00)
8.	*Nirmal*	*C. roseus*	1989	8.6 (2.8)*	10.3 (3.1)*	Crude drug	1.2 (1.1)*
				5.6 (1.9)**	12.9 (4.7)**	Crude drug	2.3 (2.5)**

Figures in parentheses relate to checks.
*, **relate to leaves and roots, respectively.

latex (with 18% morphine) compared to the commercial check. Besides, a var. **Sanchita** with 1.2% morphine in poppy-straw as compared to 0.7% of world's best variety in Tasmania is in pipeline.

(b) *Artemisia annua* is a natural source of artimisinin, the anti-malarial drug uniquely effective against resistant races of *Plasmodium falsiparum* causing cerebral malaria. One new variety has been released: **Asha** (1988)—resulted from the population improvement programme, produces > 60% more biomass with 120% more crude drug and 200% more artemisinin (0.035 kg against 0.012 kg in check) per unit area than the introduced bulk.

(c) Indian henbane (*Hyoscyamus niger*) a source of tropane alkaloids, namely hyoscyamine and hyoscine with antispasmodic and antitussive properties. One variety has been evolved: **Aela** (1984)—an induced mutant, registers more than double the yield of crude drug and nearly one and a half times more biomass than the local bulk. In addition, an unbranched mutant var. **Aekla** with most conducive plant architecture for higher yield of biomass is in pipeline.

(d) Egyptian henbane (*H. muticus*) is a rich source of hyoscyamine tropane alkaloid. The following two varieties have been developed; **NP 41** (1985)—a product of line breeding, gives >40% more crude drug from almost comparable biomass per unit area vis-a-vis the local bulk. **HMT-1** (1986)—an induced tetraploid genotype, gives 38% more crude drug from about 15% more biomass than the local bulk.

(e) Pyrethrum (*Chrysanthemum cinerariefolium*) is a para-medicinal plant as a source of natural pyrethrins used against mosquito menace. A new variety has been evolved as a result of HS family selection. This variety, named **Hansa** (1985) gives better yield of flowers (141%) with 180% more crude drug giving 260% more pyrethrins yield than the commercial check in vogue (0.36 kg against 0.10 kg/ha in check).

(f) Periwinkle (*Catharanthus roseus*) is a perennial source of vinblastine and vincristine used for treatment of human neoplasms and ajmalicine against hypertension. The new variety developed is **Nirmal** (1989)—a line breeding product, gives ≈ 200% more yield of both leaves and roots than the local check, with crude drug content at par. However, owing to higher yield of leaves and roots, the final yield of crude drug is 232% more in leaves and 174% more in roots as compared to the check.

B. AROMATIC PLANTS

Aromatic plants yield essential oils which are extensively used in pharmaceutical, perfumery, cosmetic, confectionary and beverage industries. Genetic improvement programme has been intensively pursued at CIMAP for the following economically important essential oil bearing plants: Cymbopogon, Mentha, Vetiver and Lavander. The resulting 16 superior varieties evolved so far are listed in Table 2 and described here for each crop.

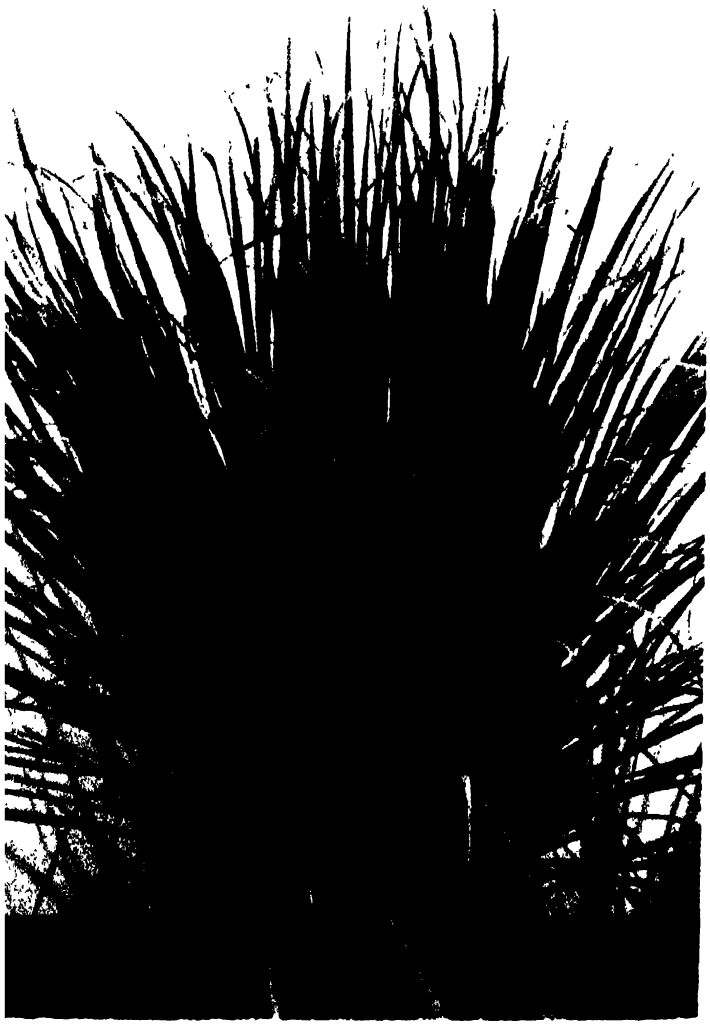
(a) East Indian Lemongrass (*Cymbopogon flexuosus*) is a rich source of lemongrass oil containing high proportion of citral raw material for natural synthesis of vitamin A. Three varieties of this crop have been released: **Pragati** (1985)—originated from repeated clonal selection, gives ≈ 50% higher yield of both oil and citral per unit area than the standard check—OD-19, and is well adapted to subtropical areas of the country. **Cauvery** (1989): a clonal selection, yields both lemongrass oil and citral nearly double the commercial check and is better adapted in peninsular India. **GRL-1** (1987)—resulted from segregational variability in seed progenies of OD-19, it is a lemongrass variety but yields geraniol oil comparable to palmarosa. Being vegetatively propagated, it is a rich supplement to palmarosa and is easier to grow.

(b) North Indian lemongrass (*C. pendulus*): Like *C. flexuosus*, this species is also a source of lemongrass oil and citral. Its cultivation is most successful in subtropical and *tarai* regions of North India. One new

Table 2: Improved varieties of aromatic plants released for commercial cultivation

	Improved var.	Crop	Year of release	Oil yield (kg/ha)	Active constituents of oil		
					Name	%	Yield (kg/ha)
1.	*Pragati*	*C. flexuosus*	1985	200 (135)	Citral	85 (87)	186 (120)
2.	*GRL-1*	*C. flexuosus*	1987	143 (136)	Geraniol	85 (78)	122 (106)
3.	*Cauvery*	*C. flexuosus*	1989	69 (34)	Citral	85 (87)	57 (30)
4.	*Praman*	*C. pendulus*	1987	245 (110)	Citral	84 (70)	206 (77)
5.	*Manjusha*	*C. winterianus*	1987	469 (288)	Citronellal	43 (26)	201 (75)
6.	*Mandakini*	*C. winterianus*	1987	338 (209)	Citronellal	35(26)	118(54)
7.	*Trishna*	*C. martinii*	1986	301 (218)	Geraniol	93 (93)	280 (203)
8.	*PRC-1*	*C. martinii*	1986	322 (230)	Geraniol	93 (93)	299 (214)
9.	*Sugandha*	*V. zizanioides*	1987	30 (21)	—	—	—
10.	*Sher-e-Kashmir*	*L. officinalis*	1987	167 (70)	Linyl acetate	60 (43)	98 (30)
11.	*MAS-1*	*M. arvensis*	1983	338 (213)	Menthol	85 (75)	287 (160)
12.	*Hyb.-77*	*M. arvensis*	1985	400 (338)	Menthol	85 (85)	340 (287)
13.	*MSS-5*	*M. spicata*	1985	348 (253)	Carvone	70 (60)	244 (152)
14.	*MCAS-2*	*M. cardiaca*	1985	225 (124)	Carvone	66 (59)	148 (73)
15.	*Kiran*	*M. citrata*	1988	239 (172)	Linalool	48 (44)	115 (76)
16.	*Supriya*	*M. viridis*	1987	330 (55)	Carvone	66 (43)	218 (24)

Figures in parentheses relate to checks.



Praman (North Indian lemongrass)

variety has been released: **Praman** (1987)—a clonal selection prolifically tillering, very fast regenerating and well-adapted to drought prone areas; this variety yields > 120% more oil and citral per unit area than the standard check, RRL-16.

(c) Citronella Java (*C. winterianus*) provides renowned citronella oil with citronellal and geraniol — the major constituents used widely in perfumery and cosmetic industries. The two new varieties released are: **Manjusha** (1987)—emanated from repeated clonal selection, registers above 60% superiority over the commercial check for oil yield per unit area. It is widely adapted to Indo-Gangetic plains and NE Indian conditions. **Mandakini** (1987)—emanated from repeated clonal selection and same as var. Manjusha in its performance, but it is specifically well-adapted to *tarai* zone of Uttar Pradesh.

(d) Palmarósa (*C. martinii* var. *motia*): It produces palmarosa/rosha oil with high geraniol content, used in high grade perfumery. Two varieties have been released: **Trishna** (1986)—a synthetic population resulting from population improvement programme, gives around 40% more yield each

of oil and geraniol per unit area as compared to commercial bulk. **PRC-1** (1986)—resulted from selection, its performance is the same as that of var. Trishna.

(e) Vetiver (*Vetiveria zizanioides*): Its roots provide highly valued khus oil for essential oil industries in India. The new variety evolved is **Sugandha** (1987)—an induced autopolyploid, yields ≈40% more oil from roots than the bulk check.

(f) Lavander (*Lavendula officinalis*): A temperate plant introduced in the Kashmir valley from Bulgaria. It is a rich source of linyl acetate constituting the major proportion of the oil used in perfumery and cosmetics. The new variety that has been released is named **Sher-e-Kashmir** (1987)—a single plant selection, yields >130% oil and > 225% linyl acetate per hectare over the introduced bulk check (Karlovo).

(g) Japanese mint (*Mentha arvensis*): It is a valuable source of natural menthol present as high proportion of the oil obtained from green herbage. Two varieties have been released: **MAS-1** (1983)—a clonal selection from the parent material ex-Thailand, yields 60% more oil and ≈80% more menthol per unit area than the commercial check. Its oil has a very high conjealing point (25°-26°C against 5°-10°C in the check), hence industrially highly valued. **Hyb.-77** (1985)—a hybrid clone possessing the same oil features of var. MAS-1 but more vigorous, giving 30% more oil yield than the latter.

(h) Common spearmint (*M. spicata*): Its oil with carvone content is highly valuable in flavouring and confectionary industries. The superior variety evolved, **MSS-5** (1985), is a simple clonal selection from an introduced bulk ex-USA, yields 38% more oil and 60% more carvone per hectare than the bulk check.

(i) Scotch spearmint (*M. cardiaca*): It is a good source of spearmint oil extensively used in confectionary and beverage industries. An improved variety has been released: **MCAS-2** (1985)—a clonal selection from an introduction ex-USA, yields>81% more oil and >50% more carvone per unit area than the parental (introduced) bulk check.

Japanese mint, MAS-1 (*Mentha arvensis*)

(j) Bergamot mint (*M. citrata*): The mint oil from this species, commonly known as 'American lavender', is widely used in perfumery and cosmetic industries. Major constituent of oil is linalool and linyl acetate. The new variety released is: **Kiran** (1988)—an induced mutant, registers ~40% superiority for oil yield and >50% for linalool yield per hectare over the commercial bulk check.

(k) Garden mint (*M. viridis*): An aromatic culinary herb, its oil possesses carvone which imparts the characteristic flavour used widely in pharmaceutical and cosmetic industries. The superior variety evolved is: **Supriya** (1987)—a clonal selection, gives extremely high performance with respect to its oil and carvone yields per unit area, correspondingly 500- and 800-fold more than the local bulk.

Basic Research: New Vistas and emerging Scenario

In addition to researches fraught with pragmatism, CIMAP is also carrying out mission-oriented basic research for promoting the growth of science in medicinal and aromatic plants. Some of the important findings are summarized here:

1. Based on nuclear DNA (2C value) variation, phylogenetic relationships and evolutionary divergence have been ascertained in *Papaver* spp., *Cymbopogon* spp., *Hyoscyamus* spp., and *Withania somnifera, Coleus forskohlii, Vetiveria zizanioides,* and *Cassia angustifolia.*

2. Karyomorphology including chromosomal instability in lemongrass and opium poppy has been determined.

3. Occurrence of cytomixis, syncyte formation, paracentric inversion and monosomic forms in *Papaver somniferum, P. dubium, Hyoscyamus muticus* and *Panax pseudoginseng* have been described, perhaps for the first time.

4. Presence of two novel phenomena: (i) *somatic neo-reduction* causing somatic segregation without taking the advantage of spindle formation and metaphase co-orientation, and (ii) *morphogenic sieve* conferring greater totipotency to balanced

eupolyploids rather than to unbalanced aneupolyploids have been propounded for the first time in *Papaver somniferum* and *Hyoscyamus muticus*, respectively.

5. Genetics of economic attributes in terms of variance components, heterosis and allied genetic parameters and inheritance of discrete variation in opium poppy, *H. muticus* and *H. niger* has been successfully assayed.

6. Stability of biosynthesis of secondary metabolites in lemongrass and opium poppy biparental progenies (BIPs) has been worked out.

7. Genetic changes in plant architecture and chemical profile through gamma rays-induced mutagenesis have been brought out in *H. niger* and *P. somniferum*. Irradiation has also opened novel possibility of creating hyperdiploidy in *H. niger*.

8. Selection criteria for genetic upgradation of vegetatively propagated crops have been reinforced by authentication of selection differential (s) through repeated evaluation preferably over time and space.

9. Selective divergence generating greater hybrid vigour so as to ensure genetic upgradation by clonal selection in hybrid progenies has been enunciated in pyrethrum.

Concluding Remarks

An array of genetically improved varieties of M&A plants has been evolved and released for commercial exploitation. Additionally, mission-oriented basic research has extended the canvas of research activities in genetics and plant breeding. The need is to initiate new ventures in genetic engineering for harnessing the potential of these plants and to strengthen technology transfer in right perspective to reap maximum advantages of released cultivars for rural development and export promotion.

Besides the author, other scientists involved in Genetics and Plant Breeding programme are: Drs B.R. Tyagi, U.C. Lavania, N.K. Patra, S.P. Singh, H.O. Mishra, R.K. Lal, O.P. Dhawan and J.R. Bahl at Lucknow; Dr A.K. Singh and Vedram Singh at Bonera; Dr R.N. Kulkarni at Bangalore, and Dr M. Mani at Kodaikanal. □

Commercial Plant (1 tonne/day) for Sodium Azide commissioned based on IICT Technology

Sodium azide is used as an intermediate for the preparation of lead azide—a primary explosive and detonator. Its more recent applications involve the manufacture of automobile safety air-bags, fungicides, etc. The Indian Institute of Chemical Technology (IICT), Hyderabad, had developed a process 20-25 years ago and produced small quantities of this compound for the Defence industry. Subsequently, the process was released through NRDC to a local entrepreneur who produced the compound at capacities 25-50 kg/day.

In 1988, Parsin Chemicals Ltd, Hyderabad, a company set up by a Non-Resident Indian approached IICT for acquiring the know-how and design for installing a one tonne/day plant at Hyderabad. The project was conceived primarily for exporting the product to USA and therefore the product had to meet the specification laid down by the US Defence Department.

Extensive pilot scale studies on an updated process yielded material which fulfilled all the criteria for consumer acceptability. A one tonne/day commercial plant was designed and commissioned by IICT in November 1989 which was erected at a cost of Rs 15 million. After some modifications to the equipment, commercial production was started; 15-20 tonnes of product have already been exported.

A foreign exchange earning of over US $ 5 million is expected to be realized when the plant starts operating at its rated capacity. Commercialization of sodium azide technology has been a significant achievement of IICT since USA, Canada and Japan are the only other countries producing sodium azide for the US market. □

Deckel FP3NC Milling Machine installed at CSIO

A Deckel FP3NC Milling Machine and Training System (DTS) from FRG has been installed at the Indo-Swiss Training Centre, Central Scientific

Computerized numerically controlled Deckel FP 3 NC milling machine installed at CSIO, Chandigarh

Instruments Organisation (CSIO), Chandigarh. The CNC (Computerized Numerically Controlled) technology has been introduced at the Centre as a part of training, keeping in view the tremendous impact it has made on industrial day to day working, owing to its uniqueness in various machining and material handling techniques. The technological capability of operations like turning, milling, grinding, punching and EDM is highly enhanced by coupling these with CNC.

The training in CNC technology at ISTC is now imparted through the most modern teaching methods using audio-visual aids like overhead projector, video films, worksheets, etc. The practical part of the training consists of the following:

Programming: Manual as well as computer-aided programming is done by each participant.

Simulation: Machining programme is tested and proved through simulation on computer graphics. This ensures safety both to man and the machine.

Machining: They duly proved programme is transferred to the machine console and run for machining the job. □

National Conference on Biomaterials and Artificial Organs

The Fourth National Conference of the Society for Biomaterials and Artificial Organs (India) was held during 13-14 April 1990 at the Indian Institute of Chemical Technology (IICT), Hyderabad, with financial assistance from CSIR, DBT and ICMR.

Dr A.V. Rama Rao, Director, IICT and Chairman of the Conference, welcomed the gathering and pointed out the need for close cooperation and interaction among scientists working in different disciplines like chemistry, biology, medicine and engineering for a meaningful approach to the design and development of biomaterials.

Delivering the inaugural address on 'Artificial Materials in Visual Rehabilitation', Dr Gullapalli N. Rao, Director, L.V. Prasad Eye Institute, Hyderabad, emphasized the need for newer materials with improved performance and biological tolerance. He highlighted the merits and drawbacks of the various synthetic materials currently in use in restorative and constructive eye surgery. Prof. S. Basu, IIT, Bombay, presided over the function.

The scientific deliberations with five invited lectures and 30 research papers, consisted of the following six sessions: I—Biomaterials: Synthetic and Natural; II&III—Macromolecules in Controlled Delivery; IV&V—Artificial Organs & Implants; The Biological & Engineering Aspects, and VI—Biomaterials in Dentistry. □

Prof. S. Basu of IIT-Bombay delivering presidential address at the National Conference on Biomaterials and Artificial Organs

Prof. M.M. Sharma delivers S.S. Bhatnagar Memorial Lecture

Prof. M.M. Sharma, Director, UDCT, University of Bombay, Bombay, delivered the second S.S. Bhatnagar Memorial lecture on 2 April 1990 at the Indian Institute of Chemical Technology, Hyderabad. The topic of the lecture was 'New Strategies for Separations through Reactions'.

Prof. Sharma, in his lecture, highlighted the new strategies in 'Dissociation Extraction' and 'Dissociation Extractive Crystallization' for separation of close boiling acidic/basic mixtures. He said that separation through reactions can provide reliable and economically viable alternative to established methods of separation, particularly for close boiling substances.

Prof. Sharma explained that aqueous solutions of hydrotropes have proved good solvents for separating close boiling substances dissolved in a suitable water immiscible solvent. Further, extractive distillation has also been possible with hydrotropes and excellent results have been realized for the separation of 2-6-xylenol/*p*-cresol, *o*-chlorophenol/phenol, etc.

He said that separation with aqueous micellar solutions and micro-emulsions by selective solubilization have been carried out. Experimental data with solid mixture like *o*-nitrotoluene / *p*-nitrotoluene, *o*-nitrochlorobenzene / *p*-nitrochlorobenzene, etc. containing *ortho* derivative at 5 to 10%, bring out the efficacy of these new strategies of separation.

Prof. M.M. Sharma delivering Bhatnagar Memorial Lecture

Prof. Sharma further said that using the new method, separation of close boiling substances like *m*- and *p*-xylenes; isobutylene and butene-1; *m*- and *p*-cresols + 2,6-xylenol; ethanol+isopropanol + *tert*. butanol, etc. via alkylation and/or esterification, particularly through the use of ion exchange resins as catalysts, can be realized.

Earlier, the eminent scientist and chemical engineer was felicitated by IICT on becoming a Fellow of the Royal Society, London. The meeting was presided over by Dr S. Varadarajan, Chairman, Research Council of IICT, who enumerated the achievements made by Prof. Sharma in a short span of time. Dr A.V. Rama Rao, Director and Dr P.S. Murthy also spoke in the honour of Dr Sharma. Dr U.T. Bhalerao, Deputy Director and Head, Organic Chemistry Division-II, IICT, proposed a vote of thanks. □

Prof. T. Viswanathan addresses National Seminar on Information & Library Network

Prof. T. Viswanathan, Director, Indian National Scientific Documentation Centre (INSDOC), New Delhi, delivered the keynote address on 'INFLIBNET - Some Thoughts' at the National Seminar on Information & Library Network, organized jointly by the U.P. Library Association and the National Botanical Research Institute (NBRI), Lucknow, on 13 April 1990. In his address Prof. Viswanathan emphasized that the INFLIBNET project should take off immediately with the help of existing telecommunication facilities instead of waiting for another couple of years for the satellite link to become functional. He said that there was an urgent need for developing indigenous databases as the international databases were prohibitively expensive. The country has all the software necessary for developing its own databases. He further added that bibliographic databases are of no avail unless they are backed up by actual sources of documents. The users are invariably interested in going through the original source document of his interest, and in that case the document supply service assumes a great importance.

He pointed out that the INFLIBNET project has ignored reports and theses from its central cataloguing system. The proposed on-line union catalogue has taken into account only the periodicals. □

Prof. T. Viswanathan delivers Keynote Address at Seminar on Management of Information Industry in 21st Century

"Cooperation in information sharing has become the need of the day as against compartmentalization", said Prof. T. Viswanathan, Director, INSDOC, New Delhi. He was delivering keynote address at the Seminar on Management of Information Industry in 21st Century, organized jointly by the local chapters of the Society for Documentation and Information Science and The Institution of Engineers (India), Jamshedpur, during 13-15 April 1990. Prof. Viswanathan also said that the country was left with no option but to develop its own information databases at the earliest.

Citing an example of sharing information, Prof. Viswanathan said that if a particular institution was required to subscribe to the critically important periodicals in the world, an annual outlay of Rs 5 to 6 crore would be required. This was an impossible figure to mobilise for any institution, more so with burgeoning number of publications worldwide and rocketing prices every passing year. In such a situation, it was only natural that all such similar institutions shared together the collection. He added that the information network need not necessarily be an electronic one. □

PROGRESS REPORTS

SERC-Madras Annual Report : 1988-89

The Structural Engineering Research Centre (SERC), Madras, has brought out its annual report for 1988-89. According to the report the institute pursued its R&D activities under the following heads: Dynamic behaviour of framed foundations for rotating machinery; Fatigue behaviour of steel offshore structures; Dynamic response analysis of ship hull structures for propeller-induced excitations; Computer-aided analysis and design of structures to survive shock loads due to blast and impact; Analysis, design, and construction of wind disaster resistant structures; Linear and nonlinear behaviour of structures and structural components; Software development, computer-aided design, and interactive graphics; Development of interactive computer graphic systems and software for dynamic analysis of structures; Analytical and experimental investigations on transmission line towers; Development of an expert system for free-standing steel lattice microwave and transmission line towers; Design and production techniques for fully and partially prestressed pretensioned concrete beams; Design methods for partially prestressed concrete structural components; Nonlinear and dynamic response of hyperboloid cooling towers and pressure vessels subjected to wind and transient loading, Special concretes and concrete composites and Construction techniques and concrete products and investigations of failures and repair of structures. The sponsored research pursued by SERC during the year, related to: Use of fibre reinforced concrete in the construction of strong rooms. Investigations on static and fatigue strength of stiffened steel tubular joints used in offshore structures and studies on the analysis of a missile launcher structure (Phase-1).

The work related to dynamic tests on concrete beams reinforced with steel fibres was completed. In addition to steady state dynamic tests, a limited number of impact tests were also carried out; two reports were prepared based on the study. A new project: Studies on the dynamic behaviour of rotary type machine foundations, was taken up. Studies under this project would be concentrated on undertuned framed type foundations for 500 MW turbo generator sets.

An automatic dynamic test facility, 100 kN servo controlled hydraulic actuator with associated and electronic controls, was installed.

A detailed study was conducted on excessive vibrations experienced by elevated conveyor galleries at the iron ore project at Bailadilla (M.P.), and a report prepared for the National Mineral Development Corporation, who had sponsored this study. Also, a state-of-the-art report on dynamic modelling of structures, including case studies, was prepared.

Fatigue tests were carried out on an unstiffened steel tubular T joint with equal chord and brace diameter of 220 mm and 5.8 mm wall thickness. The joint was subjected to fatigue testing under constant amplitude loading of 40 kN with a frequency of 2 Hz. The specimen developed cracks at 700,000 cycles at the saddle point of the chord member. The crack propagation in the joint was being studied with the help of a crack microgauge.

The on-line fatigue/dynamic testing system with a 500 kN actuator for fatigue testing and a 100 kN actuator for dynamic testing, was commissioned. The test set-up includes: two hydraulic power packs, electronic control consoles, data acquisition unit, and two HP 9000-320 series personal computers. The Fatigue Laboratory Application Package Software (FLAPS) was implemented.

A state-of-the-art report and an annotated bibliography on dynamic response analysis of ship hull structures and a report on 'Studies on performance of isoparametric finite elements for static and vibration analysis of beams and plates' were prepared.

A computer program based on lanczos algorithm was developed, and the one for subspace iteration technique for bonded matrix form was implemented on the Prime 750 system; preliminary testing of the latter program was carried out.

The nature and extent of structural damages caused by severe cyclones in the past were studied and a comprehensive report on the types of materials and methods of construction for walls and roofs of houses and industrial structures was prepared. This report also brings out the improvements in traditional construction techniques to withstand cyclonic winds.

A state-of-the-art report on 'Full-scale measurement of wind load and wind effects of structures' was prepared. This report is based on an extensive literature search on the full scale field experiments conducted on wind sensitive structures in different parts of the world. It highlights the factors that are important for planning and conducting full scale field experiments.

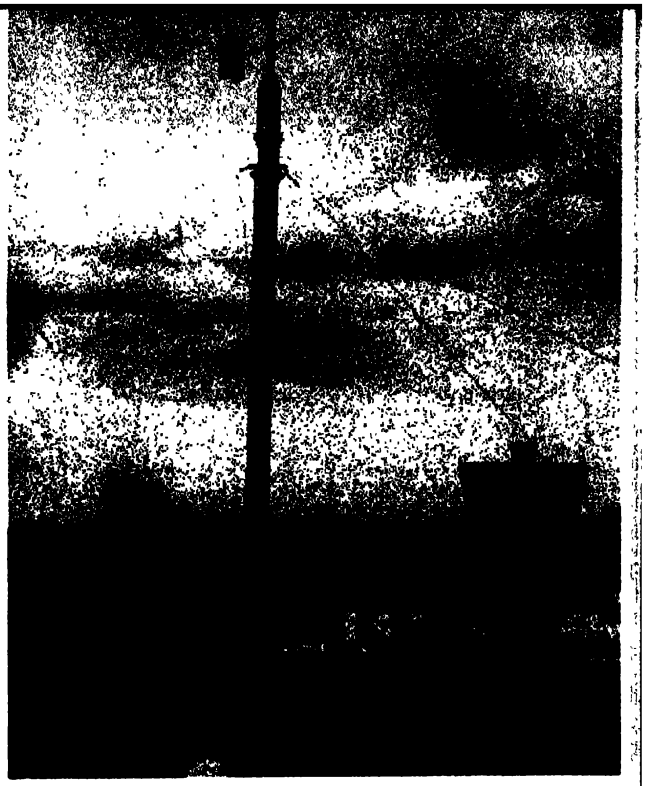
Holographic interferometry was applied for determination of thermal deformation of an insulator disc caused by high voltage leak and to measure the surface deformation of a water tank model. Speckle photography was applied to determine rigid body motion and displacements of objects. Residual stresses in valve components were determined by dissection technique. An experimental investigation on Class 900 valves for seismic qualification, and static and dynamic analyses of a launcher structure for project Agni were also carried out. Photoelastic analysis of a trunnion block was carried out for a defence establishment and a preliminary report was prepared based on the results.

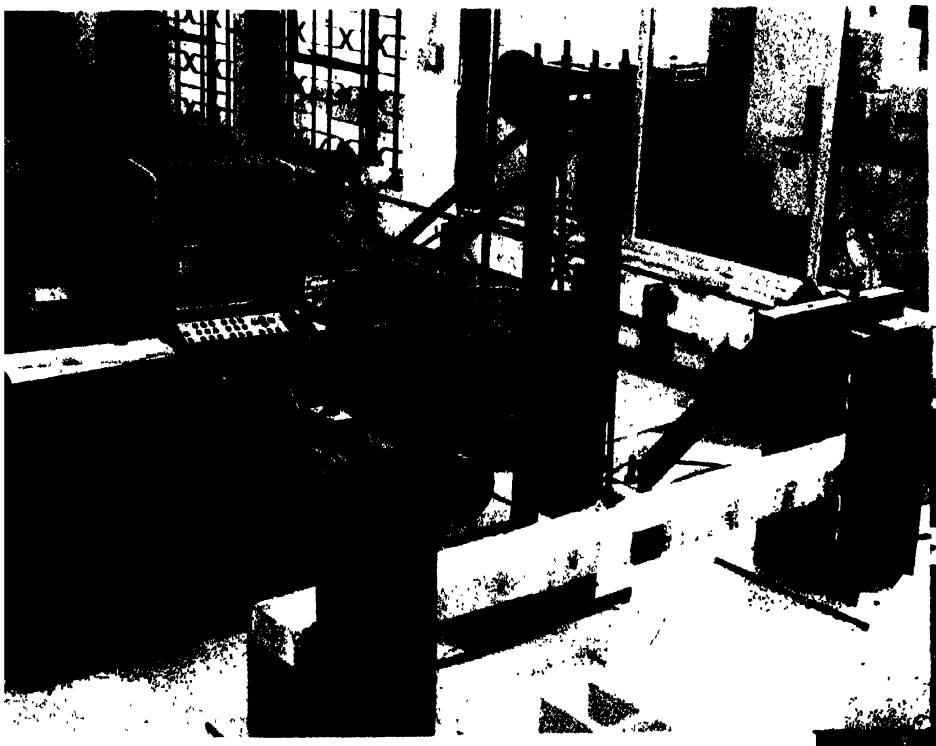
Instrumentation and measurements of strain of a small ship during its load-out were carried out for a leading ship builder. The load-out experiment corresponds to transferring of the ship from land to a floating barge. Electrical resistance strain gauges were welded to the hull and the strain were measured all through the loadout operation.

A versatile software package was developed to generate, interactively, fully detailed engineering drawings with special reference to reinforced concrete structures. FORTRAN-callable graphics library routines were developed for use in IBM-PC-compatible computer systems under MS DOS operating system.

Also, a totally interactive and user-friendly computer aided detailing and drafting system was developed for reinforced concrete structural components such as slabs, beams, columns, and footings. The system accepts input data through visual interaction and automatically produces detailed drawings including elevation, plan and cross-sections, including bar bending schedules and bills of materials. This system was integrated with the general purpose drafting system to facilitate easy modification and graphic editing of the drawings by the user.

A fully integrated and completely graphics-oriented software package was developed for the design of multistorey reinforced concrete plane frames for use on IBM PC-compatible systems. MICSTRAN (Microcomputer Structural Analysis) programs were suitably modified and necessary eigen-value subroutines incorporated for calculation of fundamental frequencies. Eigen values and eigen vectors are obtained by matrix iteration technique. The user can specify the required number of modes, maximum number of iterations, and the required accuracy. The frequencies and eigen vectors are obtained as output. Post-processor for plotting the structure with node numbering, member numbering, and plotting of various modes is incorporated for plane truss and plane frame problems. Lumped mass idealization was adopted in the formulation. The programs were imple-





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1. *Crack depth measurements using crack micro gauge on welded tubular 'T' joint under fatigue loading*
2. *A 3-cup anemometer mounted atop Fatigue Testing Laboratory building for continuous monitoring of wind speed measurements*
3. *Testing of a reinforced concrete beam under impact loading*
4. *Core cutting from a Fibre Reinforced Concrete wall element designed for construction of strong rooms*

mented on IBM PC/AT-compatible systems and validated.

Under the studies related to Transmission Line Towers, data from two full scale tests on 400 kV towers were collected and studied in detail. A computer program was developed for on-line processing of the data collected. Analytical investigations were also carried out on these towers.

Mathematical formulation for nonlinear and failure analysis of towers, taking into account both geometric and material nonlinearities, was completed. A highly versatile software package was developed using the above formulations. The results obtained from the program were compared well with the test data collected from full-scale tests.

EXTASY, an expert system for analysis and design of microwave tower, was developed incorporating Heuristics in the form of IF-THEN-WITH rules. Knowledge acquisition for these rules was automated. The system can make new design decisions based on analogical reasoning. A blackboard architecture was used as the fundamental problem solving strategy.

A report on 'Studies on effect of imperfections on stress resultants in hyperboloid cooling towers' was completed during the year. The proof checking of analysis of two cooling towers of Kakrapar Atomic Power Project for dead load and wind loads was completed for the Nuclear Power Corporation (NPC), Bombay.

A process was developed for the production of lightweight, coir-fibre reinforced vermiculite concrete partition boards.

The Centre has been identified as a participant, along with the Central Building Research Institute, Roorkee, in a collaborative effort (under UNCHS-USSR/GOI project) for 'International cooperation for technology transfer in the production of indigenous building materials and components in developing countries'. In connection of this project, an exchange of visits took place between Indian and Soviet scientists. Soviet experts from the Latvian Building Research Institute (LBRI), Riga, visited SERC during 20-23 March 1989. They were exposed to the various building techniques developed at SERC. Also, project profiles for various concrete products and construction techniques were prepared and submitted to UNCHS, Nairobi, for discussion at a workshop to be held in Riga in May 1990.

During the year, 27 papers were published and 8 papers were presented in symposia/seminars. □

Effect of wind and freshwater discharge on hydrography and circulation of the Western Bay of Bengal

Shri A. Suryanarayana, Scientist, Physical Oceanography Division, National Institute of Oceanography (NIO), Goa, studied in details the importance and influence of the time-dependent freshwater discharge through multi-ports and the external forces owing to wind stress during the NE and SW monsoons on the hydrography and the circulation of the waters of the western bay. The salient features of the study are:

From the various parameters and their variations in space and time considered in this study, the effect of freshwater discharge directly or in the form of freshwater content (F) has been found to have dominating influence on the water characteristics and the circulation features. This parameter influences the upper layers of the western bay, up to a maximum of 50 m, over a wide stretch of the boundary zone extending to 150 km from the physical boundary to transient, flexible frontal zone defined by the isohaline (33.0×10^{-3}) in the offshore. Below this depth the influence of the wind stress on the circulation is evident. A quasi-permanent cross shelf front exists around 16-17°N lat., separating the waters of the western boundary of the bay into the north and south. Observational reports though well documented (Radhakrishna, Bhatathiri and Devassy, 1982 Gopala Krishna and Sastry, 1985 to cite a few) have not been in detail. Equally important are the findings of Rao and Sastry (1981) on the geostrophic currents within the bay and the influence of freshwater on the circulation.

Broadly, the less saline waters along this boundry and the changes observed as one moves from north to south, in addition to the gyres having vertical penetration to depth of over 400 m, deserve citation. These gyres continue to maintain the signatures of freshwater discharges along the coast as could be seen from the appreciable percent of freshwater content at distances far removed from the coast. Under the influence of such persistent per cent freshwater content, the density distribution and the computed relative geostrophic currents, as expected, indicate the alternate current flows in the meridional direction. This feature is akin to the bandular structure replaced by the gyral pattern along the level surfaces. The bandular structures along the iso-baths with northward or southward components are probably well developed during SW monsoon as against NE monsoon where conspicuously in the central zone the structure is dominated by the gyral flow (at least from freshwater content computed). Such linear structures could be associated with low period planetary waves influenced to certain extent by topography.

The transport computed from wind stress distribution, though identical during both the monsoons, the marginal outflux observed is in fairly good agreement with the analytical findings of Babu (1987) based on one dimensional model of wind-driven circulation and those of Shetye, Shenoi, Antony and Krishna Kumar (1985).

A time lag of about two months is noticed for the freshwater discharges to the maximum Ekman transport. The increase in the time lag is evi-

dently seen as one moves from north to south.

The upwelling indices clearly bring out the negative upwelling (sinking) predominant in the course of a year. This is so in the northern zone. In the central, however, prevailing upwelling (Varadachari, 1958; Murty and Varadachari, 1968; Varadachari and Sharma, 1967) is well supported by the upwelling index.

Shri Suryanarayana was awarded Ph.D. degree by the Andhra University, Waltair, for his thesis based on these studies. He worked under the guidance of Dr J.S. Sastry, Deputy Director and Head, Physical Oceanography Division of NIO, and Prof. B.S.R. Reddy, Department of Meteorology and Oceanography, Andhra University. □

NEW PUBLICATIONS

CECRI Research Output: A Bibliographic Database of Papers 1953-89

The Library and Information Sciences Division of the Central Electrochemical Research Institute (CECRI), Karaikudi, has brought out a bibliographic compilation entitled 'CECRI Research Output: A bibliographic database of papers 1953-89', containing references to about 2800 original and review papers published by the scientific staff of the institute.

The subject matter has been arranged under nine groups: Batteries and Fuel Cells; Corrosion Science and Engineering; Electrochemicals; Electrometallurgy; Electrochemical Materials Science; Electrodics, Electrobiology and Pollution Control; Industrial Metal Finishing; Electrochemical Instrumentation and General. The entries have been made yearwise and under each year, alphabetically by authors' names. Author, source and year indexes have also been provided at the end. An analysis of these references has also been appended.

The database has been created using dBase III plus and necessary search software has been developed and used for getting the output in the desired format. Analysis part has been done using Lotus 1-2-3.

Further information regarding the publication can be had from the Director, CECRI, Karaikudi 623006. □

Abstracts of Ph.D. Theses on Electrochemistry 1968-88

Over 50 research scholars and scientists have obtained their higher degrees, especially Doctor of Philosophy, of various universities in India, working on a variety of problems at the Central Electrochemical Research Institute (CECRI), Karaikudi, during 1968-88. Senior scientists of the institute have guided such research activities. The title volume is a compilation of abstracts of these research theses.

The abstracts have been grouped under the following areas: Corrosion, Electrochemical Materials Science, Electrochemicals, Electrodeposition and Metal Finishing, Electrodics/Fundamental and Theoretical Studies, Electrometallurgy/Thermics. Author, supervisor and keyword-in-title indexes have also been provided.

Enquiries pertaining to the publication (compiled and edited by R. Ramasamy, N. Meyyappan and A. Lalitha) may be directed to: The Director, CECRI, Karaikudi 623006. □

CBRI participates in BUILD TECH 1990—Exhibition on Building Materials & Technologies

The Central Building Research Institute (CBRI), Roorkee, participated along with HUDCO, NBO, NBCC, and some private organizations in the Build Tech 1990 Exhibition sponsored by HUDCO and organized in New Delhi, during 11-13 May 1990. The objective of the exhibition was to display latest building materials and technologies from India's top organizations/companies under one roof, for the benefit of the users. The exhibition was inaugurated by Shri P.S.A. Sundaram, Joint Secretary (Housing), Ministry of Urban Development. The CBRI stall was attended by the institute's Extension Centre in New Delhi.

The CBRI display included new building materials and technologies from industrial/agricultural wastes such as clay fly ash bricks, calcium silicate bricks (sand lime and fly ash lime), sintered fly ash light-weight aggregate, bloated clay aggregate, ferrocement door shutters, gypsum binder and board from phosphogypsum, solid concrete blocks, R.C. plank roofing, L-pan units and prefab brick panel system.

Special publications of the institute on the theme of the exhibition and related topics were displayed and a large number of these were purchased by the visitors. Some of these are: *Building Detailing and Fixtures, Your own House, Live Better with Mud and Thatch*, and *Building Economics and Productivity*. The usefulness of the new building materials and components displayed was amply demonstrated and the users made enquiries about the sources of their availability. The entrepreneurs sought detailed project feasibility profiles for these items for setting up industrial units. □

CONFERENCE BRIEFS

International Symposium on Mineral and Metallurgical Processing

Dr T.C. Rao, Director, Regional Research Laboratory, Bhopal, participated in the CONTROL '90 — Second International Symposium on Mineral and Metallurgical Processing, held at Salt Lake City, USA, during 26 February—1 March 1990 and presented a paper entitled 'Industrial Application of Heavy Medium Cyclone Model'. He also served as chairman

of a Technical Session on Control Strategies and Process Optimisation. The symposium was attended by about 4500 delegates from universities, R&D institutions, industries, government agencies from all parts of the world. It was organized by the Society for Mining, Metallurgy, and Exploration, Inc. USA.

Also, Dr Rao visited the Department of Metallurgical Engineering, University of Utah and the Department of Mining and Mineral Engineering, Virginia Polytechnic and State University, Virginia. He also visited the University of California, Berkeley and gave a seminar on 'Modelling of Some Fine Coal Processing Techniques'. During these visits, he exchanged views on modelling of unit operations in mineral and coal preparation operations and also application of dry beneficiation techniques for upgradation of minerals and coals. □

PERSONNEL NEWS

Appointments/Promotions

At the Indian Institute of Chemical Biology (IICB), Calcutta, Dr (Smt.) Suman Khowala has been appointed Scientist B, [Grade-IV (1)] with effect from 11 April 1990. □

Honours & Awards

Dr N.R. Ayyangar

Dr N.R. Ayyangar, Head, Organic Chemistry II Division, National Chemical Laboratory (NCL), Pune, has been awarded the Department of Chemical Technology K.H. Kabbur Memorial Silver Jubilee Lectureship by the University of Bombay for his outstanding contributions to chemical sciences.

Dr S. Sivaram

Dr S. Sivaram, Head, Polymer Chemistry Division, NCL, Pune, has been nominated as a member of editorial board of a new journal, *Macromolecular Reports*, to be published by Marcel Dekker Inc., N.Y., USA, from 1990.

Dr Paul Ratnasamy

Dr Paul Ratnasamy, Deputy Director, NCL, Pune, has been nominated on the editorial board of *Zeitschrift fur Physikalische Chemie*, (GDR), for the period 1989-1993.

Dr M.C. Srinivasan

Dr M.C. Srinivasan, Scientist, Biochemical Sciences Division, NCL, Pune, has been awarded the Prof. J.V. Bhat Eureka Forbes Award for excellence in research in microbiology conducted in a laboratory in India over the last five years (1985-1989). He shares the award with Dr P.T.C. Nambiar of ICRISAT, Hyderabad.

The award instituted by the Prof. J.V. Bhat Memorial Committee consists of a cash prize of Rs 10,000 and a scroll. □

Transfers

Shri N.A. Khan

Shri N.A. Khan has joined the Publications & Information Directorate, New Delhi, as Section Officer (w.e.f. 3 May 1990) on transfer from the Regional Research Laboratory, Jammu. □

PATENTS FILED

124/DEL/90: An improved process for the synthesis of trimethyl borate, S.K. Mehta, J.M. Upadhayay & A.K. Suri —Regional Research Laboratory, Jammu.

125/DEL/90: An improved process for the preparation of aluminium hydroxide gel powder having antacid properties, B.J. Bhalala, P.M. Oza, V.M. Sheth & V.P. Pandya—Central Salt & Marine Chemicals Research Institute, Bhavnagar.

155/DEL/90: A process for making composite material using gypsum and agro waste materials, useful as building material, S.K. Mehta, R.A. Sayanam, P.S. Johar & H.R. Khajuria—Regional Research Laboratory, Jammu.

156/DEL/90: Improvements in or relating to the deposition of semiconducting films by the brush plating technique, S.K. Rangarajan, K.R. Murali, V. Subramanian, N. Rangarajan, A.S. Lakshmanan — Central Electrochemical Research Institute, Karaikudi.

157/DEL/90: A process for the preparation of a new proton accepting polymer useful for the preparation of polymer having drag reducing properties in hydrocarbon fluids, S.N. Shintre, S. Malik, M.G. Kulkarni & R.A. Mashelkar—National Chemical Laboratory, Pune.

158/DEL/90. A process for the preparation of new proton donating polymer useful for the preparation of a polymer having drag reducing properties in hydrocarbon fluids, S.N. Shintre, S. Malik & R.A. Mashelkar — National Chemical Laboratory, Pune.

159/DEL/90: A process for the preparation of a new polymer useful for drag reduction in hydrocarbon fluids, S.N. Shintre, S. Malik & R.A. Mashelkar—National Chemical Laboratory, Pune.

160/DEL/90: A process for the preparation of a new polymer useful for drag reduction in hydrocarbon fluids in exceptionally dilute polymer solutions, S. Malik, S.N. Shintre & R.A. Mashelkar—National Chemical Laboratory, Pune.

168/DEL/90: An improved process for the preparation of phenol, dihydroxy benzenes & 1,4-benzoquinone by hydroxylation of benzene, P.P. Moghe, P. Ratnasamy, G.R. Venkitakrishnan, A. Thangaraj, A.V. Pol, M.G. Kotasthane, S.S. Biswas, A.S. Tambe & P.K. Bahirat—National Chemical Laboratory, Pune. □

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CSIR NEWS

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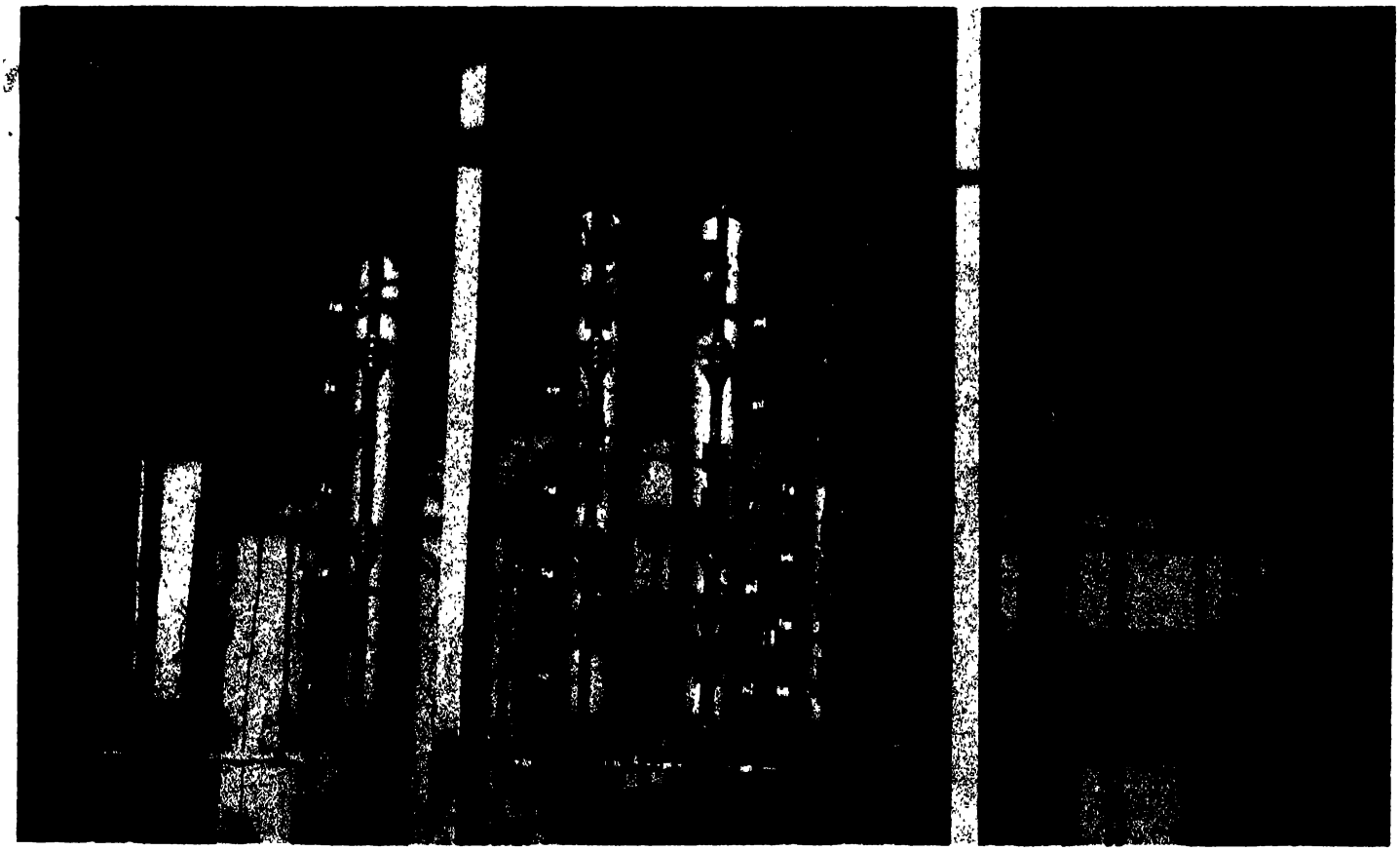

CFRI has developed a process for producing solvent refined coal—a potential additive for improved cokemaking (p. 146). Shown here is the coal hydrogenation pilot plant at CFRI in which bulk samples of SRC are being produced

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International Symposium on Land Subsidence

The Central Mining Research Station (CMRS), Dhanbad, organized an International Symposium on Land Subsidence, at CMRS during 11-15 December 1989. The objective of the symposium was to apprise the persons/organizations connected with various subsidence prone activities, of the various impacts of subsidence owing to natural and man-made causes, and to share the knowledge generated from research conducted by scientists and the experiences of the engineers working in the field. More than 250 delegates and invitees from Australia, China, Japan, Italy, Poland, Israel, USA, FRG, France, The Netherlands, Sweden and India attended the symposium.

Welcoming the guests and delegates at the inaugural function, Dr B. Singh, Chairman of the Organizing Committee of the symposium and Director, CMRS, projected the contributions of CMRS in the field. He said that CMRS had developed approaches and formulae for design of pillar underground for subsidence control. The subsidence studies conducted by CMRS had helped the coal mining industry to extract more than 10 million tonnes of coal from underneath and in the vicinity of surface properties, which would otherwise have not been possible. More than 100 problems of this nature had been studied by anticipating subsidence parameters, Dr Singh added.

Dr N.C. Saxena, Secretary, Organizing Committee and Head, Subsidence Research Group of CMRS, introduced the theme of the symposium. According to him, subsidence owing to various natural and man-made activities has been damaging not only surface properties but also surface environment.

The Director General of Mines Safety, Shri V.C. Varma was the Chief Guest on the occasion. He, in his keynote address, opined that there is no escape from the fact that large extraction of minerals from workings below ground would be accompanied by some amount of subsidence. It is for us to ensure that this inevitable phenomenon is controlled in such a manner that it does not pose a safety risk or an ecological problem. Shri Varma also reviewed the subsidence and related aspects in the perspective of world scenario.

The other important dignitaries who spoke on the occasion were: Shri P.R. Sinha, CMD, Bharat Coking Coal Limited; Shri S.P. Mathur, CMD, Central Mine Planning and Design Institute; Shri A.N. Banerjee, Chairman, Environmental Appraisal Committee, Government of India; Shri G.Padmanabhan, Chief Mining Adviser to the Railway Board, Dhanbad; Prof. D.K. Sinha, Director, Indian School of Mines and Prof. D.P. Singh, Professor of Mining, Banaras Hindu University.

The opening session came to an end with a vote of thanks expressed by Dr N.C. Saxena.

The inaugural session was followed by nine technical sessions in which following aspects of land subsidence were discussed:

1. Theory and modelling of subsidence phenomenon due to various activities;
2. Case studies on subsidence owing to mining, pumping of water and petroleum from below ground, natural and other man-made causes;
3. Environmental impacts of subsidence;
4. Monitoring of subsidence movements; and
5. Precautionary and preventive measures.

Thirty-five papers and six keynote addresses were presented by eminent researchers, technologists and educationalists. Each deliberation was followed by lively discussions, specially on the theme of subsidence owing to pumping of water and causes other than mining.

A committee was formed under the Chairmanship of Prof. D.K. Sinha, Director, ISM, to draft recommendations for furture course of action in respect of research and development in the field of land subsidence, specially in the Indian subcontinent. The other members of the committee were Shri V.K. Singh, GM (Environment), CMPDI, Ranchi; Dr M.M. Seam, Add. CME, CMPDI, Ranchi; Shri A. K. Rudra, Deputy Director, DGMS; Mr Albert Hunninghaus, WBK, Bochum, FRG; Prof. Jiang Guan, Associate Professor, Shandong Institute of Mining & Technology, PRC; Shri S. Dani, Deputy Manager (Geology), PPCL; Shri H.C. Mishra, AEM, MECON, Ranchi; Shri K.K. Malhotra, Head, Env. Exp. and Management Division, BCCL and Dr N.C. Saxena, Head, Subsidence Group, CMRS. The committee reviewed different aspects of subsidence owing to the various causes, and status of subsidence research in India, its implications and requirements in future, and made necessary recommendations. The views expressed by the participants from abroad were also taken into consideration.

A field trip was organized for the delegates and guests to the Jharia coalfield to give them a first hand impression of the subsidence, mine fire, land reclamation and other aspects of land subsidence.

The symposium concluded on 15 December 1989. Delivering the valedictory address Shri P.R. Sinha, CMD, BCCL, Dhanbad, called for taking a balanced view where there existed a gap between theory and practice or between scientific requirements and economic options.

The symposium made the following recommendations:

1. A National Committee on Subsidence be formed to go into various aspects of subsidence related activities in the country and also to suggest the various measures to be taken to safeguard the interest of the total ecosystem and human habitat. The

committee may have the following composition:

Chairman, CIL, as President/Chairman; Director, Institute of Exploration and Reservoir, ONGC, as Co-Chairman; Dr N.C. Saxena, Head, Subsidence Research Group, CMRS, as Co-Chairman & Convener; Representatives of the Department of Environment and Forest, Central Ground Water Board, Geological Survey of India, Oil India Limited, Indian School of Mines, Indian Bureau of Mines and Central Water Commission. The Committee may co-opt other members or form sub-committee.

(2) It would be appropriate to conduct research on subsidence owing to various man-made and natural activities, and for this purpose, an Institute of Subsidence Research be set up at a suitable place in India. The institute should be an autonomous body and should have linkages with the Department of Environment and Forest and other government departments, educational and industrial units concerned with subsidence. Detailed phasewise proposal may be prepared by the National Committee for this purpose.

(3) In order to further exchange the knowledge available in the field of subsidence, exchange programmes should be formulated and frequent discussions between experts and scientists be held.

(4) The progress of subsidence research, specially in the Indian subcontinent vis-a-vis progress of research in other countries, be reviewed at regular intervals. For this purpose, another International Symposium on Land Subsidence may be organized in 1995 in India. In addition, there should be national level seminars at more frequent intervals.

(5) The subsidence research should be intensified by different institutes through allocation of substantial resources.

(6) The technology for carrying out surveys is being constantly upgraded and this factor should be taken into consideration in developing accurate mine plans and also plans of other subsidence prone areas, thereby ensuring accurate measurement and monitoring of subsidence. As there is a dearth of scientifically educated surveyors in the country, appropriate action should be taken for starting degree and postgraduate level courses in this discipline. A committee comprising representatives of industry, educational institutions, DGMS, GSI, Survey of India, and IBM be set up to look into this aspect. The recent incidences of subsidence in non-coal mining sector call for initiation of subsidence research in this sector.

(7) Study of subsidence owing to any man-made or natural activity needs prolonged monitoring. In some cases the time may be 10 years or more. Such activities require large resource inputs. Keeping this in view, the symposium recommended that the user industry and the departments should pool their resources to fund subsidence studies.

(8) Advanced technology like aerial photogrammetry may be developed for the purpose of monitoring subsidence. If necessary, initial assistance may be obtained from developed countries like FRG, USA, etc. This is all the more necessary owing to inaccessibility of some areas and involvement of large subsidence prone areas.

(9) There may be many regions experiencing subsidence owing to various activities. Potential areas may be identified at the earliest and studies be initiated.

(10) Numerical and simulation model for predicting subsidence may be developed.

(11) Effect of subsidence on environment and mitigating measures may be studied to develop a methodology for subsidence management at a quicker pace.

(12) Structural designs for subsidence prone areas may be developed and standardized.

(13) Suitable measures for backfilling of unapproachable underground workings may be developed. R&D in this sphere as also verification of efficacy of such backfilling may be carried out.

(14) A legislation may be brought to prohibit further constructions over mineral bearing areas.

(15) A systematic rehabilitation plan for subsidence prone areas need to be prepared in advance for implementation at different stages. State governments may be requested to provide land and infrastructural facilities to expedite rehabilitation work. □

National Seminar on Scope of Essential Oil Industry in U.P.

A National Seminar on Scope of Essential Oil Industry in Uttar Pradesh was organized by the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, in collaboration with a social organization, Bharat Jyoti, Lucknow, on 11 & 12 April 1990, at CIMAP.

The seminar was inaugurated by the Governor of Uttar Pradesh, Shri B. Satyanarayana Reddy, who in his address emphasized the role of essential oil industry in development of the industry and the state. He asked the growers and perfumers to come up with new perfumes for the international market and give a boost to the industry. This would help solve the problem of unemployment as well. He applauded the role of Kannauj in boosting the essential oil industry in the country.

Shri Reddy also released a souvenir brought out by Bharat Jyoti and felicitated eminent persons from different walks of life for contributions in their respective fields.

Dr R.S. Thakur, Director CIMAP,

and Chairman of the Organizing Committee, in his message hoped that the seminar, apart from highlighting the vast resources and availability of various essential oils and resinoids in U.P., would result in establishing direct contacts among growers, distillers, distributors, marketing agencies and exporters. The seminar would also prove useful in bringing to the notice of the growers, the specific requirements of various essential oils, so that the available resource could be channelized in the right direction to meet the future requirements.

Earlier, welcoming the Governor and delegates, Shri O.P. Virmani, Deputy Director, CIMAP, said that in spite of sufficient potential for cultivation and natural resources available in U.P., the essential oil industry could not progress to the desired extent. He told that CIMAP is giving more attention towards carrying over fruits of research to the masses, in collaboration with government departments, industrialists and voluntary agencies.

The seminar was attended by a large number of entrepreneurs, growers, scientists and small scale industrialists. Prof. S.C. Bhattacharyya, a leading chemist, was amongst the faculty who delivered lectures on cultivation, distillation, and processing and marketing of essential oils.

Dr R.S. Thakur was given the Best Scientist award of the year, during the seminar. □

Shri B. Satyanarayana Reddy, Governor of U.P., inaugurating the National Seminar on Scope of Essential Oil Industry in U.P.

Dr A.P. Mitra inaugurates Indo-US Workshop on Environmental Risk Analysis

Dr A.P. Mitra, Director General, CSIR, inaugurated a five-day Indo-US Workshop on Environmental Risk Analysis at the Indian Institute of Technology (IIT), New Delhi, on 12 December 1989.

In his address, Dr Mitra outlined the policy of CSIR with reference to the academic and research pursuits in the areas of chemical hazard and risk analysis. The risk analysis studies, initiated by CSIR laboratories during 1986-87, cover critical areas of chemical reactor safety, mathematical modelling of chemical releases and their effects, fault free synthesis and analysis, equipment reliability and the risk probability. The basic objective of CSIR in all these activities is to translate the inhouse academic and scientific knowledge into a form which can be used to interpret and explain the forces at work in industrial risks. Dr Mitra highlighted the achievements of NCL-Pune. IICT-Hyderabad, RRL-Jorhat, CLRI-Madras, NEERI-Nagpur, ITRC-Lucknow and CMERI-Durgapur in this regard. He called for building up a strong indigenous capability in chemical hazard and risk analysis to make the country self-reliant in this important area. From the viewpoint of collection, sharing and pooling of safety data, Dr Mitra suggested for establishing an effective inter-institutional linkage between well-known national and international organizations and industries.

The workshop was organized under the auspices of the Indo-US Sub-Commission on Science and Technology and was sponsored by the Department of Science and Technology; Ministry of Environment and Forests; CSIR; Oil and Natural Gas Commission; India Meteorological Department; Disaster Management Institute, Bhopal; National Environmental Engineering Research Institute Nagpur; Central Pollution Control Board; Rajasthan State Pollution Control Board; Rajasthan State Productivity Council and IIT-Delhi. National Science Foundation, USA; Department of Energy, US Government, US-EPA and the British Council were the cooperating organizations.

The workshop was designed to review the state-of-art in risk assessment of petroleum and chemical process industries and to evolve appropriate strategies for chemical emergency preparedness and transfer of know-how to various user agencies, safety inspectorates and other enforcement agencies.

Quantification of consequences and risks as a result of chemical accidents, engineering failures and

Dr A.P. Mitra delivering the inaugural address at Indo-US Workshop on Environmental Risk Assessment at IIT-Delhi

health effects was identified by the Indo-US Sub-Commission as a thrust area in its meeting on Science and Technology held in November 1987. The Indo-US Workshop was conceived on the basis of the recommendations of the Sub-Commission.

The participants included representatives from safety inspectorates, Directorates of Industries, Central and State Pollution Control Boards, academic and research institutes and chemical industries. Forty faculty members from USA, UK and India attended the workshop. Also, specialists from WHO, EEC, IAEA and UNEP were intited to the workshop.

Scientists from CLRI, IICT, NEERI and ITRC also attended the workshop. The following special lectures were delivered: Risk Assessment for Chemical Plants with recourse to Monte Carlo Simulation and Integration of Risk Analysis and Reliability Concepts (Prof. P. Khanna, Director, NEERI, Nagpur); Importance of Environmental Risk Analysis to prevent deleteration effects on human health (Prof. P.K. Ray, Director, ITRC, Lucknow); Analysis of Cascade or Domino Effects in Chemical Accidents (Dr K.V. Raghavan, Deputy Director, CLRI, Madras); and Risk Analysis of a Gas Processing Complex in India (Dr Asad Ali Khan, Deputy Director, IICT, Hyderabad). □

IICT celebrates Its Foundation Day

The Indian Institute of Chemical Technology (IICT), Hyderabad, celebrated its first Foundation Day on 1 April 1990.

In one of the functions held on this occasion, Dr A.V. Rama Rao, Director, IICT, highlighted the achievements of the institute. He said that in the fields of pesticides and drugs, the institute had covered new milestones. New process technologies for Chlorpyriphos and for pesticidal fraction known as 'Vepacide from *neem* oil had been developed and would shortly be commercialized. Further, based on the technology and designs provided by the institute, commercial production of Butachlor (a weedicide), DDVP (an insecticide and fumigant) and Pheromones (used for integrated pest management) was started. An important organophosphorous insecticide Monocrotophos was being produced by four parties with a total capacity of 1900 tonnes per annum. Regarding drugs, the technologies for Flurbiprofen, Norfloxacin, Etoposide, Mitaxantrone, Sulbactam, Timolol Maleate, Azidothymidine and Pyrazinamide had been passed on to the Indian drug industry. Dr Rama Rao also highlighted the achievements made in other research areas like Intermediates, Catalysts, Surface Coatings and Polymers, Simulation and Optimisation, Oils and Fats, etc. He said

Dr A.V. Rama Rao, Director, IICT, Hyderabad, addressing the staff on the occasion of Foundation Day celebrations of IICT

that on account of quality R&D work undertaken by the institute, research contracts assigned to IICT by various private and public sector undertaking institutions came to about Rs 46.00 million whereas the cashflow during the same period was approximately Rs 20.00 million.

Dr S. Varadarajan, Chairman, Research Council of IICT and the Chief Guest, lauded the institute's efforts in the national R&D and said that, both in basic and applied fields, the laboratory had made rapid progress. Stating that old chemistry and old biology are now things of the past, he cautioned the scientists in the selection of the research areas. It is very difficult to draw a boundary between the modern chemistry and modern biology. So, a scientist working in these areas has to be good at allied subjects. Furthermore, for identifying future projects, we have to take into account so many factors like waste disposal, environmental pollution, etc.

Dr U.T. Bhalerao, Scientist G and Head, Organic Chemistry-II Division, IICT, proposed a vote of thanks.

On this occasion, certificates/mementoes were presented to 85 staff members for their contributions in the form of good publications, devotion to work, etc.

Also, 14 children of the IICT employees were awarded the certificates and cash awards for their meritorious performance in the SSC and Intermediate examinations.

Later on, the family members of the IICT staff, who were invited on the occasion of the Foundation Day, were taken round the laboratory and were explained the work being carried out in the institute. □

CFRI produces Solvent Refined Coal: A Potential Additive for Improved Cokemaking

Solvent Refined Coal (SRC) has been obtained as a solid pitch like product in the SRC-1 process developed at the Central Fuel Research Institute (CFRI), Dhanbad, by solvent extraction of non-coking coal, oil agglomerated washery middlings and lignite following the slurry phase hydrogenation route, in a 500 kg/day pilot plant under elevated temperature and pressure. Investigations with 5 to 10% addition of SRC in conventional coal blends have resulted in increased coking propensities with enhancement of fluidity, plastic property, coke type and coke strength besides reduction in ash content of the resultant coke. It may be possible in future to replace considerable amount of the imported coking coal by the addition of 10% SRC having ash content of about 8%.

Bulk samples of SRC containing 7-8% ash produced from high ash Samla seam coal of Raniganj coalfield and similar high ash oil agglomerated washery middlings have been produced by the technique developed in CFRI. These bulk samples were supplied to and tested in the Research and Development Centre for Iron & Steel of SAIL, Ranchi and also in CFRI. The results were extremely encouraging.

In India, the steel plants are trying to limit the ash content in coal blends to 17 ±0.5% which is being achieved at present by blending imported low ash coal as a sweetening agent in the coking blends, especially for the high capacity blast furnaces with stringent specifications in terms of coke strength and its reactivity. Because of meagre resources of prime coking coal in the country and the abundantly available non-coking coals and washery middlings, SRC technology appears to be an appropriate avenue for the rational utilization of indigenous coal resources resulting in less dependence on the imported coking coal.

Addition of 5-10% SRC has indicated positive improvements in coal blend/coke properties in coke types G1 to G2/G3, maximum fluidity raised to 500 to more than 2000 ddpm, plastic property, coke strength, i.e. M_{10} value lowered by 2-4 units and overall reduction in the ash of coke to the desired limit. This can as well be used as a binder for making briquettes which can be used up to a maximum of 30% of the coal blend (may be for non-coking coal or the normal blend).

Steel Ministry's support for the SRC Project

Primarily to establish the feasibility of the SRC technology, a project was approved in 1988 for financial support (the budget is Rs 20.75 million) by the Programme Management Board (PMB) under the National Mission for Iron and Steel through RDCIS (SAIL). Availability and linkage of non-coking coals and middlings have been ascertained jointly by CMPDI-Ranchi, CFRI-Dhanbad and RDCIS (SAIL)-Ranchi.

The project is basically divided into two phases running concurrently. Phase-1 deals with modification and instrumentation of the coal hydrogenation pilot plant of CFRI to produce bulk samples of SRC-1 for carrying out pilot oven carbonization tests with the coal blends. Phase-II comprises design and procurement of a fully instrumented process development unit (PDU) for conducting process optimization studies and generating scale-up data. The total time span of the project is 4 to 5 years.

Other aspects of R&D work being studied presently include preliminary techno-economic evaluation, conceptual design of a demonstration plant (10 tonnes/day), pretreatment of coal prior to dissolution and use of a hydrogen-rich gas such as coke oven gas (instead of pure hydrogen) in the process. □

4 MeV Accelerator for Radiation Therapy

Linear accelerator machine is a source of high energy X-rays needed for the treatment of cancer. The treatment

consists of administering a specific amount of X-ray dose to the tumour, at the same time causing minimum damage to the surrounding healthy tissues. X-rays deposit a part of their energy in tissues as they pass through the body. This results in random dissociation of organic molecules leading to annihilation or biological kill of cancer cells. The application of high energy machines to radiation therapy of cancer patients has been particularly stimulated by new technical developments which provide financially attractive alternative to cobalt units. It is estimated that a good number of radition therapy machines are needed in the country. Presently, these are being imported at exhorbitant cost (around Rs 8.50 million).

An indigenous 4MeV medical linear accelerator has been developed and installed in the Radiotherapy Department of PGI, Chandigarh, for the treatment of cancer. The development was made in a record time of two and a half years, with the joint efforts of the Central Scientific Instruments Organisation, Chandigarh; SAMEER, Bombay and PGI, Chandigarh under the sponsorship of the Department of Electronics. The machine is now in regular use and about 15 patients are treated daily.

CSIO developed the handling system (stand, gantry and the base-frame), the gantry drive, angle control and angle display system, optical range finder and field lighting system. System integration (at CSIO as well as at PGI) and the installation of patient couch were also the responsibility of CSIO. SAMEER, Bombay, developed the linac tube, RF system, microwave system, modulator, water cooling system, and collimator and shields.

The clinical application of these machines imposes stringent requirement on the machine design. Some of these are:

- The radiation beam must be well defined and variable in size.
- The radiation dose pattern should be uniform and stable.
- The radiation dose delivered to the patient has to be accurately monitored.
- The radiation beam has to be steerable, so that it can be applied in any desired position and direction.
- The position of the treatment couch needs to be movable in three dimensions with high precision.

Brief System Description:

To achieve above objectives the linear accelerator installation is mainly divided into three units:

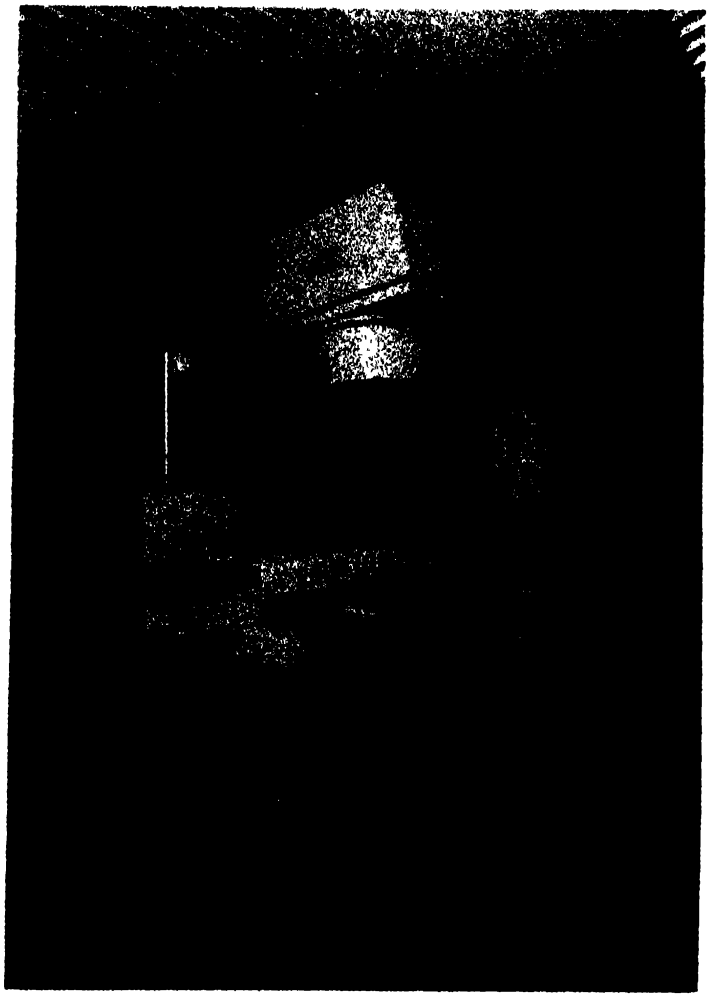
(a) *Gantry and Stand:* Linear accelerator tube, microwave system, collimators and optical systems are housed in the gantry. The gantry is coupled to a rigid vertical stand through a bearing. It rotates smoothly, through a useful range of 360° at speed of 0.1 to 1 rpm by a control motor.

The source to axis distance is 100 cm as per international standards. The source rotates isocentrically with the gantry. There is a gap of 55 cm between the isocentre and bottom of the collimator. The machine produces full treatment field up to 26 × 26 cm and delivers a dose up to 200 rad/min at the isocentre. The focal spot at the target is less than 3 mm in diameter.

(b) *Control Console:* The compact control console has been designed using latest concepts. From the console, the operator can set prescribed dose rate, monitor total dose, set maximum treatment time and maximum dose, initiate or terminate treatment and monitor machine operation.

It also incorporates a comprehensive interlock system to turn off the machine automatically if any abnormal occurrence takes place.

(c) *Patient Treatment Couch:* The main requirement of the couch is its



4 MeV medical linear accelerator for radiation therapy

rigid stability. The movements of the couch-top in vertical, longitudinal and transverse directions and its isocentric rotation are controlled by variable speed motors. The couch can be operated from its control desk or by a remote unit placed outside the treatment room.

The indigenous development of the machine will result in substantial savings in foreign exchange, and better servicing and maintenance. Any alterations can also be incorporated easily at the instance of the user.□

CSIR Programme on Global Change

Enhanced UV-B Effects on Terrestrial and Aquatic Plants

A gradual reduction in the stratospheric ozone layer resulting from excessive release of air pollutants, is increasing the terrestrial receipt of solar Ultraviolet-B radiation (280-320 nm). Exposure of terrestrial and aquatic ecosystems to enhanced UV-B may cause a number of remarkable morphological, physiological and even genetical alterations in plants, which may lead to a profound impact on biomass productivity and yield.

The National Botanical Research Institute (NBRI), Lucknow, has undertaken a study to identify the potential UV-B effects on plants to envisage the mechanism of UV-B action and to understand the protective mechanism developed by plants to cope with harmful effects of UV-B radiation. Crop plants will be grown under enhanced UV-B condition and its effects will be studied beginning from seed germination to flowering and fruiting stages. Morphological, developmental, cytological, physiological and biochemical changes will be studied throughout the growth cycle. Emphasis will be given to study the effects of interaction of other environmental stresses (particularly temperature and CO_2) with UV-B. An attempt to study one or two tree species during seedling stages will also be made. Aquatic unicellular algae have also been selected because of their proven suitability as an experimental tool to enable us to understand the basic mechanism(s) of UV-B action. These studies may be helpful in modelling and future agricultural management.

Preliminary study initiated in the laboratory with a unicellular alga (cyanobacterium) *Anacystis nidulans* indicates that UV-B affects photosynthesis and nitrogen metabolism and the visible radiation plays a significant role in expressing the harmful effects on these two crucial processes. Study with crop plants will be taken up soon on receiving consignment of UV-B lamps, polyester filters and radiometer to radiate the plants in laboratory and field. □

CLRI and IICT to carry out Risk Assessment of IPCL Plants

The Central Leather Research Institute (CLRI), Madras, has received a work order from the Indian Petrochemicals Limited (IPCL) to study the potential hazards (including runaway reactions) and risks arising from materials processed, stored or handled at the sites of (i) Bicomponent Acrylic Fibre (DSAF) plant, (ii) Polypropylene Copolymer (PPCP) plant, (iii) Gas Turbine Power Plant (GTPP) and (iv) Aromatics Expansion (GAP) plant at IPCL, Baroda Complex. The effects of possible chemical accidents in the form of liquid pool fires, confined and unconfined vapour cloud explosions, boiling liquid expanding vapour explosions, release of toxic gases/vapour and thermal runaway of exothermic reaction systems, which might affect onsite and offsite areas will be estimated. Log-log plots between chemical discharge quantities and affected distances will be developed to demonstrate the hazard ranges for both typical and adverse weather conditions for each category of material.

The Cell for Industrial Safety and Risk Analysis (CISRA) at CLRI, is the coordinating agency for the assignment. The safety group of the chemical engineering division at Indian Institute of Chemical Technology (IICT), Hyderabad, is participating in the investigations. Specialized services from The Netherlands Organization for Applied Research (TNO), Apeldoorn, in the fields of computerized information on past chemical accidents and Event Probability Analysis will be availed.

The Chemical Engineering team of CISRA has already executed during 1989-90 the hazard analysis of the new refinery to be set up by MRL at Cauvery Basin, aromatic complex to be set up by NAPCO at Manali, Madras, and Chlor-Alkali plant of the Andhra Sugars, Kovvur. Also, IICT, CLRI, NEERI, ITRC and TNO have jointly investigated the risk potential of Hazira Gas Processing Complex of ONGC during 1989-90.

The IPCL assignment involves Maximum Credible Accident and Consequence (MCAC) analysis effect and damage calculations, limited HAZOP and FTA and probability study of group events. CLRI and IICT are well equipped with specialized facilities and computer software to undertake such studies in India. Foreign exchange saving to the tune of Rs 1.2 million is anticipated from this assignment. □

Planning of Mass Rapid Transit System for Delhi

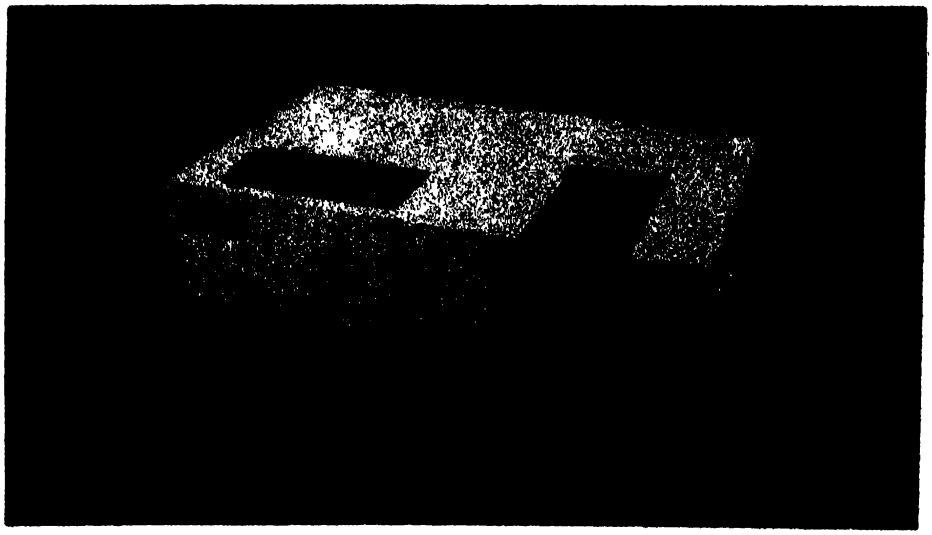
The Central Road Research Institute (CRRI), New Delhi, has completed a sponsored assignment, Planning of Mass Rapid Transit System for Delhi, as consultant to Rail India Technical and Economic Services on behalf of

Delhi Administration. The objectives of the study included the development of transport sub-models for the base year (1981) and projection of passenger transport demand for the horizon year (2001) and recommendation of an overall mass rapid transit system for Delhi.

The four stage transportation planning process, which included trip generation sub-models, trip distribution sub-models, modal split sub-models and trip assignment sub-models, was utilized for this purpose. Household travel survey data alongwith land use data for horizon year and base year were provided by the Delhi Development Authority. Simple and operable transport sub-models were developed for the base year and utilized for the projection of transport demand for the horizon year. The models were planned for minimal data requirements, incorporating only the significant parameters with reasonable forecasting accuracy. Socio-economic aspects of the residents of Delhi Urban Area were also considered. A number of alternative transport networks consisting of road system only; road system and existing surface rail; road system and existing surface rail and metro; road system and metro were considered and evaluated. The criteria for comparative evaluation of these alternatives included passengers served, passenger kms performed, passenger hours spent and passengers carried out per km. On the basis of the above analyses, a mass rapid transit system for Delhi was recommended which essentially consists of a multi-modal system for roads, surface rail, metro and high capacity bus system. Priority segments were also recommended. □

Agreement signed for manufacturing NCL-developed IR Spectrophotometer

Infrared spectroscopy provides a unique, non destructive technique for the determination of molecular structure of an organic compound.



IRS 4000 IR spectrophotometer developed at NCL, Pune

Under the Department of Science and Technology (DST) Instrument Development Programme, work on a grating monochromator Infrared Spectrophotometer was initiated at the National Chemical Laboratory (NCL), Pune and first unit was completed in 1984. This technology was further updated with the inclusion of a microprocessor and the first Indian microprocessor-controlled IR spectrophotometer was ready in 1986.

The performance of this equipment was demonstrated to the Instrument Advisory Committee of DST which visited NCL in June 1987. Subsequently, performance of the instrument was also demonstrated to the representatives of Blue Star Ltd, Bombay, in 1989. An agreement with the company was signed at a specially arranged function at DST in March 1990.

The present demand for this type of instrument is around two to three hundred units per annum, which is met through imports. Blue Star Ltd is planning to produce about 50 such units initially and then increase the capacity in due course. The firm expects to sale the basic spectrophotometer at around Rs 2 lakh/unit.

Afro-Asian Entrepreneurs Group at PTC-Hyderabad

The National Institute for Entrepreneurship and Small Business Development (NIESBUD), New Delhi, under the Government of India's Ministry of Industry, organized an International Training Programme on Entrepreneurship Development for Small Business Trainers/Promoters from 29 January to 23 March 1990 in Delhi. As a part of the training programme the participants visited various institutes and industrial units in Bombay, Delhi, Hyderabad, and Madras. The Hyderabad programme (28 February-3 March 1990) included a visit to CSIR-Polytechnology Transfer Centre (PTC), Hyderabad, on 28 February 1990. The visitors to PTC-Hyderabad comprised Mr Sewduth Seeruttun (Vinod), Ms Radha Prasad, Ms Maha Lutcimi, Mr Ching Chur from Mauritius and Ms Dorothy M. Mhina from Tanzania. They represented government departments/voluntary agencies and were accompanied by the NIESBUD's Training Officer.

The visitors briefly described the nature of their activities in their respective countries and assistance

they needed from PTC-Hyderabad. In general, they were looking for project ideas, resource-based technologies, skill development-cum-training facilities, and technology transfer from India to their respective countries. The visitors also told about the status of local resources and local skills available in their countries. Prof. B. R. Sant. Scientist-in-charge, PTC-Hyderabad, explained the role and functions of PTC-Hyderabad, national laboratories, CSIR and NRDC, and described some of the technologies which could be of relevance to Mauritius and Tanzania. The illustrated information provided by Prof. Sant created tremendous interest amongst the participants who wanted more details on certain specific projects. □

Sir Frederick Warner attends CSIR Workshop at CLRI

Sir Frederick Warner, internationally known specialist in industrial safety and the Principal Investigator of Flixborough Disaster in UK, visited the Cell for Industrial Safety and Risk Analysis (CISRA) at the Central Leather Research Institute (CLRI), Madras, on 28 December 1989. The chemical engineering team of CISRA demonstrated the computer software and their specialized expertise available in chemical hazard and risk analysis. On this occasion, CISRA arranged a one-day CSIR workshop on Chemical Hazard and Risk Analysis. Sir Frederick delivered the keynote lecture on Lessons of Nuclear Disasters and Their Relevance to Chemical Industry. A demonstration of the computer-aided simulator for equipment/component reliability analysis was arranged for CSIR scientists at the Centre for Electronics, Madras. Eighteen scientists from IICT, NEERI, RRL-Trivandrum, CLRI, ITRC and CMERI participated in the workshop. A brief presentation of the latest techniques developed by the CSIR laboratories in the field of chemical hazard analysis was also arranged.

Dr R.B. Mitra, Director, CLRI, delivered the welcome address and Dr G. Thyagarajan, Secretary, Commonwealth Science Council, London, inaugurated the workshop. Dr K.V. Raghavan, Deputy Director, CLRI, presented an overview of CSIR activities in Chemical Hazard and Risk Analysis. The technical session on Hazard Analysis was chaired by Dr Asad Ali Khan, Deputy Director, IICT, Hyderabad. Dr M.M. Mallikarjunan, Assistant Director, CLRI, proposed a vote of thanks. □

Children meet Scientists at CFRI and CLRI: NCERT Programme

At the instance of the National Council of Educational Research and Training (NCERT), New Delhi, 100 senior secondary level students were invited to the Central Fuel Research Institute (CFRI), Dhanbad, on 30 March 1990 with the objective of acquainting them with activities of the institute. Five popular lectures were arranged besides a question-answer session and a film show. CFRI scientists delivered talks covering topics like current R&D programmes on coal, coal for power, upgrading inferior coals, coal for iron and steel, the nature and properties of coal, including the coal geology and fuel science in general. The lectures were delivered by Dr Abhijit Sarkar, Dr D.D. Halder, Dr S.K. Verma, Shri K. Raja and Shri Samir Sen. Dr R. Haque, Director, CFRI, presided over the question-answer session in which a large number of queries from the students were answered. A specially prepared pamphlet was distributed to the students, along with other informative booklets. The programme was coordinated by Shri Samir Sen of CFRI.

Programme at CLRI

The 'Children Meet Scientists' programme at the Central Leather Research Institute, Madras, was organized on 6 March as a part of the Science Week celebrations. The programme started with a welcome lecture by Dr K.V. Raghavan highlighting the objectives of the programme. Dr S.V. Chitti Babu, former Vice Chancellor of Madurai Kamraj University gave a lecture on 'Promotion of Scientific Temper'. His lecture was followed by a presentation from Dr C.K. Mathews of the Indira Gandhi Centre for Atomic Research, Kalpakkam. Speaking on 'Nuclear energy options', he highlighted the importance and the inevitability of the recourse to nuclear energy options for maintaining the technological progress of the nation. He addressed to the commonly raised concern regarding the safety of nuclear reactors and presented an optimistic picture of what nuclear energy options could deliver to the society of tomorrow.

Dr T. Ramasami of CLRI gave a talk on 'Global warming : a growing concern'. He highlighted the importance of maintaining the levels of greenhouse gases in the environment. Presenting the multidimensionality of the problem of global warming and its consequences, he indicated the approaches to Atmospheric Modelling and possible developments of mitigation strategies suited to contain the problem of global warming. He called for a scientific approach to maintain the temperature of the planet.

Prof. T.S. Natarajan made a presentation on Teaching Aids in Science Education using an interactive computer software package and construction of electronic circuitries. His lecture was followed by a question-answer programme: 'Face to Face'.

Dr Nandakumar of COSTED described a software package useful in teaching.

Video shows were arranged on genetic engineering, bioprocessing and wild life in evolutionary ladder. The students were taken round the laboratory and were explained the principles

of spectroscopy, chromatography and electron microscopy.

Fifty-eight students attended the programme. □

DEPUTATION BRIEFS

Dr K. Balakrishnan

Dr K. Balakrishnan, Deputy Director, Central Electrochemical Research Institute (CECRI), Karaikudi, was deputed to Italy to chair a session and to present two papers in the 11th International Corrosion Congress held at Florence, Italy, during 2-6 April 1990. After attending the Congress, he went to FRG for two weeks from 7 April 1990, under the revisitation programme of the German Academic Exchange Service and visited the following universities/institutions: Free University, Berlin, Duisburg University, University of Karlsruhe, Dusseldorf University, Kern Forschung Institute, Karlsruhe and Institute of Chemical Technology, Karlsruhe. □

Prof. B.K. Bachhawat and Prof. P.N. Tandon selected for Bhatnagar Fellowships

Prof. B.K. Bachhawat, Department of Biochemistry, South Delhi Campus, University of Delhi and Prof. P.N. Tandon, Head, Department of Neurosurgery, All India Institute of Medical Sciences, New Delhi and Member, International Brain Research Organisation, have been selected for the award of Bhatnagar Fellowships for 1990-91. CSIR awards two Bhatnagar Fellowships each year to eminent active scientists working in the country, in recognition of excellence of their work in an area of S&T of interest to CSIR. This fellowship seeks to enable the awardee pursue research in his field on a mutually agreed project/programme in a thrust area of CSIR, at an institute within or outside the CSIR system, with a view to enhancing the excellence of manpower in CSIR. CSIR establishes linkages of these fellows with the corresponding groups in CSIR laboratories and seeks their advice on matters pertaining to their expertise. The fellowship is for five years, extendable in exceptional cases for suitable period and carries emoluments of Rs 8000 per month plus allowances admissible under the rules.

The earlier awardees (1989-90) are: Prof. M.M. Sharma, FRS, Department of Chemical Technology, University of Bombay and Prof. S. Chandrasekhar, FRS, Raman Research Institute, Bangalore. □

Honours & Awards

Prof. A. Ghosal

Prof. A. Ghosal, Emeritus Scientist, CSIR, chaired the session on 'Management Cybernetics' in the International Congress of Cybernetics and Systems held at New York during 11-15 June 1990.

Dr G. Lakshminarayana

Dr G. Lakshminarayana, Deputy Director and Head, Oils and Fats Division, Indian Institute of Chemical Technology (IICT), Hyderabad, has been conferred the Dayabhai Vadalia Memorial Award—1989 for the paper 'Preparation and surfactant properties of N-acyl condensates of castor seed protein isolate and hydrolysate' by R.B.N. Prasad, A. Krishnamurthy, (late) A.J. Pantulu and G. Lakshminarayana. The paper has been adjudged as the best paper appeared in 1988 in the *Journal of Oil Technologists' Association of India.*

The award is given to the senior author of the best paper published in the JOTAI during the previous year, and carries a citation and cash award of Rs 1500.

Shri Pradeep K. Srivastava

Shri Pradeep Kumar Srivastava, Technical Officer, Process Development Division, Central Drug Research Institute, Lucknow, has been given the Outstanding Young Person of India Award by Indian Junior Chamber for excellence in the field of Science. The award, carrying Rs 1001, a citation and trophy, was presented to him by Shri George M. Suncar, World President of Junior Chamber International at the National Convention of Indian Junior Chamber held in Calicut, Kerala, on 26 February 1990.

Shri Srivastava has won this award for his cartoons based on Science, which he terms as Scientoons. His Scientoons have been published by various CSIR laboratories; American Chemical Society; International Union of Biochemistry, England, and International Union of Pure & Applied Chemistry (IUPAC), Sweden. An abstract of his work on Scientoons, invited for presentation by the Royal Swedish Academy, was published in the 32nd IUPAC Congress held in Sweden. He has delivered invited lectures on Scientoons at the Bhabha Atomic Research Centre, Bombay and Thailand Institute of Scientific & Industrial Research, and National Institute of Health, Ministry of Public Health, Thailand

Dr D.S. Bhakuni and Dr A.P. Bhaduri get 1988 Ranbaxy Research Award in Pharmaceutical Sciences

Dr D.S. Bhakuni, Scientist in Director's Grade and Dr A.P. Bhaduri,

Scientist E-II, both from the Central Drug Research Institute, Lucknow,

share the 1988 Ranbaxy Research Award in pharmaceutical sciences.

Dr Bhakuni has been given the coveted industrial research award in recognition of his significant contribution to several areas of pharmaceutical sciences. He has designed and synthesized several types of nucleosides as inhibitors/substrates of enzymes involved in viral multiplication and in metabolism of nucleotides of leishmania parasites. He has also designed and synthesized nucleosides as antiallergic and anticancer agents; structure activity relationship studies on these compounds have furnished very useful information on optimization of their activities.

Dr Bhaduri has been conferred the award for his contribution to the development of new heterocyclic drugs. Six compounds reaching clinical evaluation stage reflect the accomplishment of his research objectives. His outstanding achievements are innovation of novel synthetic approach to a variety of organic compounds, exploration of new biological activities in heterocycles and fundamental studies to generate new leads. His concept of developing agents to reverse chloroquine resistance in malarial parasite is a valuable approach towards the chemotherapy of falciparum malaria. □

PATENTS FILED

170/DEL/90: An improved process for the preparation of dihydroxybenzenes and 1,4-benzoquinone by the hydroxylation of phenol using titanium containing zeolite catalyst, P.P. Moghe, P. Ratnasamy, G.R. Venkitakrishnan, J.S. Reddy, A.V. Pol, M.G. Kotasthane, S.S. Biswas, A.S. Tambe & P.K. Bahirat—National Chemical Laboratory, Pune.

171/DEL/90: An improved method for the preparation of phenol hydroxybenzene and 1,4-benzoquinone by hydroxylation of benzene using titanium containing synthetic zeolite catalyst, P.P. Moghe, P. Ratnasamy, G.R. Venkitakrishnan, J.S. Reddy, A.V. Pol, M.G. Kotasthane, S.S. Biswas, A.S. Tambe & P.K. Bahirat—National Chemical Laboratory, Pune.

172/DEL/90: A process for the preparation of (1-6′-methoxy-4′-quinolinyl)- 3 - [3″ - vinyl - 1″ - (substituted aminoacetyl)-4″-piperidyl]-2-methylene propane-1-ones and their water soluble salts, N.M. Khanna, V.K. Shukla, A.K. Dwivedi, B.S. Setty & V.P. Kamboj—Central Drug Research Institute, Lucknow.

173/DEL/90: A process for the preparation of 1-(6′-methoxy-4′-quinolinyl)-3-[3″-vinyl-1″ (N, N-dialkyl or heterocyclic amino alkyl)-4″-piperidyl] -2-methylene-propane-1-ones and their water soluble salts, N.M. Khanna, V.K. Shukla, A.K. Dwivedi, B.S. Setty & V.P. Kamboj—Central Drug Research Institute, Lucknow.

174/DEL/90: An improved process for the carbonylation of nitro compounds using novel ruthenium complex catalysts, M.M. Taqui Khan, S.B. Halligudi, S. Shukla, S.H.R. Abdi and Z.A. Shaikh—Central Salt & Marine Chemicals Research Institute, Bhavnagar.

222/DEL/90: A process for the preparation of new reactive anionic initiators useful for polymerization of vinyl monomers, D. Baskaran, P.K. Dhal, S.P. Kashikar, R.S. Khisti, B.M. Shinde and S. Sivaram—National Chemical Laboratory, Pune.

223/DEL/90: An improved process for the preparation of nitrile group containing polymers, D. Baskaran, P.K. Dhal, S.P. Kashikar, R.S. Khisti, B.M. Shinde and S. Sivaram—National Chemical Laboratory, Pune.

224/DEL/90: A process for the production of electrolytic manganese dioxide, activated manganese dioxide and chemical manganese dioxide from natural manganese ores, P.L. Sengupta, S.C. Aush, P.K. Sinha and N. Dhananjayan—National Metallurgical Laboratory, Jamshedpur.

282/DEL/90: A process for the recovery of free ammonia and ammonium compounds from liquid wastes, B.D. Dasare, M.N. Prajapati and P.M. Gaur—Central Salt & Marine Chemicals Research Institute, Bhavnagar.

283/DEL/90: Equipment for time sharing of single AC motor soft starter with more number of AC motors, U. M. Rao — Central Electronics Engineering Research Institute, Pilani.

284/DEL/90: An improved process for the extraction of pure saponin from the pericarp of *Sapindus emarginatus*, A. Sree, V.S. Rao, S.C. Basu and C. Srinivasulu—Regional Research Laboratory, Bhubaneswar.

285/DEL/90: An improved process for the extraction of supergrade palm kernel meal and oil from palm kernel, N. Sreedhara, A.D. Damodaran, C.S. Narayanan—Regional Research Laboratory, Trivandrum.

286/DEL/90: A process for coating the surfaces of mild steel and stainless steel by crystallisable coating composition, M.C. Ghose, S. Datta, S.K. Das, and K.K. Biswas—Central Glass & Ceramic Research Institute, Calcutta.

287/DEL/90: A process for the preparation of polymeric sulphonates useful as surfactant from cashewnut shell liquid or Bilawan nut liquid, T.C. Phatak and S.K. Agarwal—Central Building Research Institute, Roorkee. □

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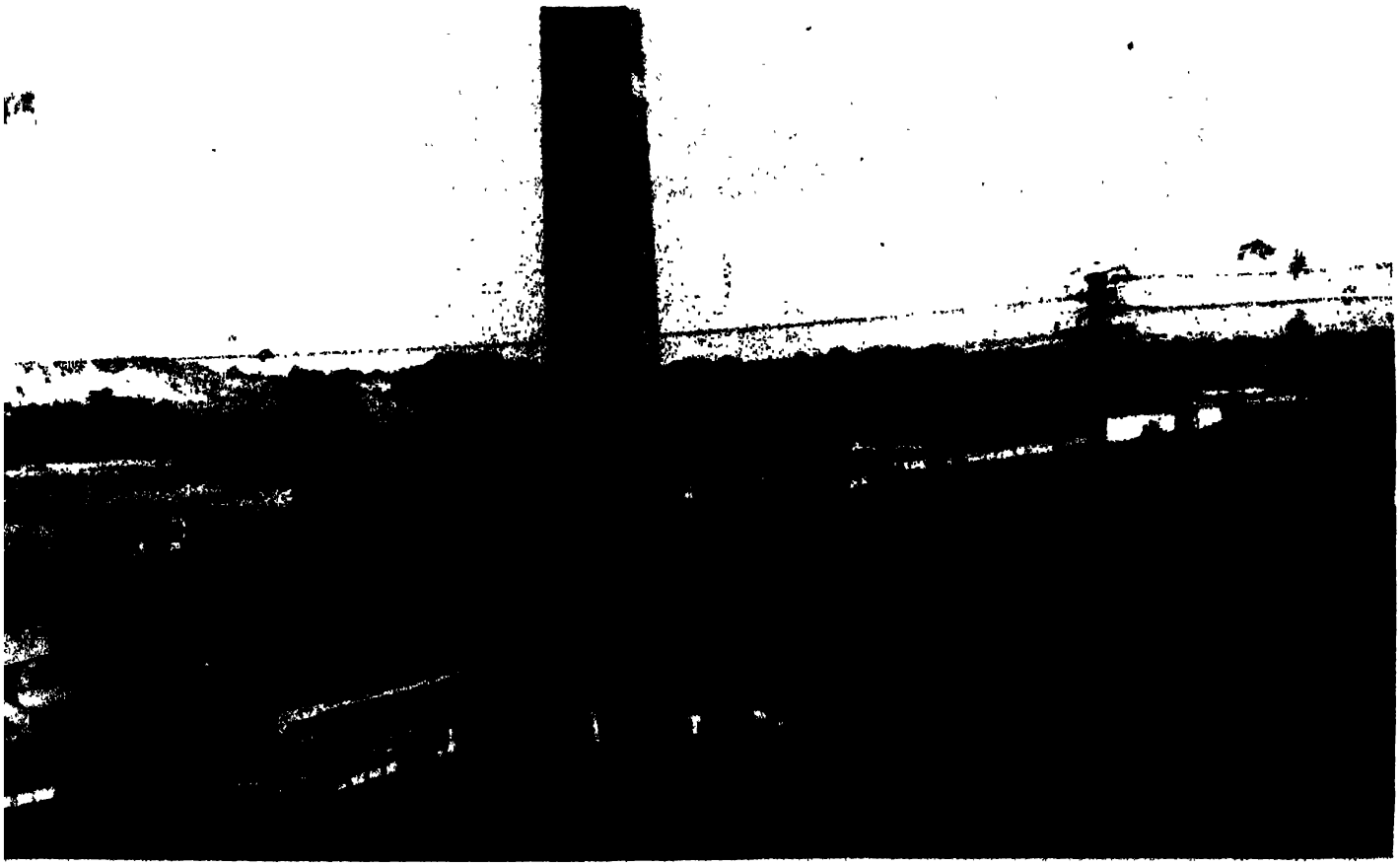

'Kumbraj' coke oven for production of metallurgical coke from low volatile medium coking coal: CFRI, Dhanbad (p.152)

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CFRI develops 'Kumbraj' Coke Oven for Production of Metallurgical Coke without using any Prime Coking Coal

Limitations of the availability of good quality coking coals in our country are well known. The gross *in-situ* reserves of prime coking coals available in India have been estimated at 5,300 million tonnes and that of medium coking coals 20,600 million tonnes. Against this, the consumption of prime coking coals in steel plants is more as compared to the medium coking coals. Thus, from the resource availability point of view, there is an imbalance in the consumption pattern of medium coking coals. Also, the reserve of low volatile medium coking coals is more as compared to the medium or high volatile medium coking coals. Keeping in view the resources of coals available in India, the Central Fuel Research Institute (CFRI), Dhanbad, has developed a beehive coke oven, popularly called 'Kumbraj' which has been designed to carbonize low volatile medium coking coals. Kumbraj is a fast coking, sole heated, recuperative oven which is almost pollution free.

The institute had developed first battery of beehive coke ovens, comprising eight ovens connected to a 55ft high chimney, which went into commercial production at Raniganj in August 1987. Later on, it was observed that the performance of the ovens could be made more economical by increasing the number of ovens from eight to ten and by incorporating some more changes in the oven design.

M/s Brahmdeo Sinha & Co who financed the installation of the first demonstration plant and invested the whole amount of risk capital, decided to dismantle their existing running battery of 30 old design beehive coke ovens, which were constructed only four years ago and could have been easily operated for another ten years, and requested CFRI to provide technical consultancy for the construction of second battery of Kumbraj coke ovens comprising ten ovens connected to a 80 ft high chimney. Accordingly, the second battery of coke ovens was constructed and commissioned in July 1989, and its performance was found to be highly satisfactory. Necessary changes in the design of first battery were also incorporated and two more ovens were added, making it also a ten oven battery connected to 80 ft high chimney. This started coke production in March 1990.

The ten-oven battery has been provided with 70 control dampers which ensure controlled flow of preheated primary and secondary air at appropriate places to achieve optimum heating of oven for efficient coking of coals and for production of good quality coke even from inferior coking coals which fail to give acceptable coke when carbonized in sophisticated byproduct coke ovens of the steel plants.

Actual coking tests carried out in the Kumbraj coke oven have established that it is possible to produce strong metallurgical coke having a stabilized M_{10} index of less than 8 from an inferior low volatile medium coking coal having an ash content of 32.5%, volatile matter content of 18.3%, caking and swelling indices of 14 and 1 respectively and maximum fluidity of only 15 ddpm. With top charging and without using any additive, no byproduct coke oven plant anywhere in the world at present can produce such strong coke from such an inferior coking coal. At present, no steel plant of our country is able to produce such strong coke with top charging even by blending imported coals to the extent of 30%. In addition, the capital investment required for installing Kumbraj coke ovens is > 25% of investment required for the same coke production capacity in byproduct coke ovens. Thus, due to lower capital investment, Kumbraj technology offers an additional advantage of coke production at a lower cost compared to the byproduct coke ovens.

On the basis of the excellent coke produced by the Kumbraj technology from inferior low volatile medium coking coals, CFRI scientists have submitted in January 1990 a concrete proposal to the CHARI Committee (Expert Committee on Metallurgical Coal, appointed by Govenment of India) for production of coke from washed low volatile medium coking coals, and its trial in large capacity blast furnaces. In view of the acceptance of the proposal by CHARI Committee, a preliminary programme is being drawn up for conducting the desired coking tests with low volatile, medium coking washed coals in Kumbraj coke oven. Blast furnace trials with large quantities of Kumbraj coke would be undertaken if the coke is found to be suitable for such trials, including in large capacity blast furnaces of steel plant.

If the blast furnace trials in steel plants are successful, it is expected that the Kumbraj technology developed by CFRI will open up an alternative route for economic production of metallurgical coke suitable for large capacity blast furnaces without using any prime coking coal for which reserves are limited in the country. This will help in removing the serious imbalance in the consumption pattern of the available resources of coals for coke making in our country. □

Workshop on Clinical Pharmacokinetics

A workshop on Clinical Pharmacokinetics was held at the Central Drug Research Institute (CDRI), Lucknow, with international collaboration, during 26-30 March 1990. This workshop was held as an inaugural programme in the series of scientific activities planned to commemorate the 40th year of CDRI. The

objective of the workshop was to create awareness among the young scientists working in the field of clinical pharmacology about the importance of clinical pharmacokinetics in rational drug therapy and patient management. The workshop faculty comprised: Prof. Brian Whiting, University of Glasgow, UK; Dr B.G. Woodcock, University of Frankfurt, West Germany; Prof. U.K Sheth,ex-Head, Pharmacology Department, Seth G.S. Medical College, Bombay; Prof. K.P. Bhargava, ex-Principal, K.G.'s Medical College, Lucknow; Dr P.K. Grover, Dr R.C. Gupta, Shri J.K. Paliwal and Dr O.P. Asthana of CDRI. The trainees for the workshop included middle level faculty members and research investigators from medical colleges and organizations engaged in research in different aspects of pharmacology, clinical pharmacology and pharmacokinetics. The workshop was sponsored by the International Union of Pharmacology, Indian National Science Academy and CDRI.

Prof. B.N. Dhawan delivering the welcome address at Workshop on Clinical Pharmacokinetics held at CDRI, Lucknow

Welcoming the trainees, faculty members and guests, the CDRI Director Prof. B.N. Dhawan spoke on the need for involvement of clinical pharmacologists in the newly emerging area of clinical pharmacology and emphasized the importance of monitoring blood levels of life saving drugs with narrow safety window. Dr Sarla Verma, Director, Medical Education, U.P., in her presidential address expressed satisfaction that CDRI had taken a lead in organizing the workshop which was the first of its kind in the country.

Prof. U.K. Sheth, during his keynote address shared with the guests his experience of over two decades in clinical pharmacology. He stressed upon the need for holding more of such workshops. Prof. Brian Whiting in his brief remarks said that clinical pharmacokinetics should provide a forum for practising clinicians and clinical pharmacologists to freely interact and recognize the significance of pharmacokinetics in rational and safer use of drugs in clinical practice. He conveyed the greetings and happiness of IUPHAR at the realization of this workshop in India. The inaugural session ended with a vote of thanks proposed by Dr P.K. Grover.

During the next four days there were lectures on various basic and applied aspects of pharmacokinetics. The trainees received practical training in the estimation of sulphamethoxypyridazine in human serum using UV spectrophotometer and learnt about the analysis of data to calculate pharmacokinetic parameters with the use of computer software. Prof. Brian Whiting conducted one and a half day problem solving session related to calculation of these parameters. On the final day of the workshop the trainees gave a brief presentation of the projects they were working on at their respective places.

In his valedictory remarks, Prof. Dhawan expressed the hope that the trainees would utilize what they had learnt in the workshop and that more interaction would be forthcoming between Indian groups working in clinical pharmacology and pharmacokinetics. Prof. Whiting expressed satisfaction over the entire proceedings of the workshop and complimented CDRI for having started full-fledged divisions of Pharmacokinetics and Clinical & Experimental Medicine. Dr Woodcock endorsed the views expressed by Prof. Whiting and hoped that there would be more such workshops in the future with still wider participation.

Prof. Sheth and Prof. Bhargava expressed satisfaction with the results achieved at the workshop and hoped that CDRI would act as a nodal centre to disperse the knowledge and strengthen the bonds of interaction between different groups involved in clinical pharmacokinetics.

Dr Grover while proposing a vote of thanks expressed the desire to hold such a workshop for the South-East Asian countries in the near future. At the end, Prof. Bhargava distributed certificates to the trainees and Smt. Dhawan presented souvenirs to the faculty members. □

Seminar on Fly Ash Utilization

The Madhya Pradesh Council of Science & Technology, with active support of the Directorate of Industries, organized a seminar on 'Utilization of Fly Ash', at Korba near Bilaspur, during 29-30 March 1990 in which

papers were invited from the Central Fuel Research Institute (CFRI), Dhanbad and the Central Building Research Institute (CBRI), Roorkee, for the benefit of local entrepreneurs and industrialists. RRL-Bhopal, NTPC, BALCO, MPSEB, MPPB and SECL also participated in the seminar.

Shri G.C. Mrig, CMD, SECL, inaugurated the seminar and also presided over the inaugural session. Shri P.B. Pathak, GGM (Finance), BALCO, Shri G.N. Karaley, GM, NTPC and Shri Harish Kedia, President, Korba Industrialists Association, in their addresses highlighted the importance of utilizing the locally available fly ash from thermal power stations for manufacturing building bricks, cement and other useful products. Shri Kedia stressed on the importance of reducing the environmental pollution. According to Shri Karaley, Badarpur is already utilizing the fly ash for making bricks for use in their own construction purposes.

In the first technical session, Shri D. Biswas of CFRI presented a paper which gave details of the know-how developed at CFRI for making building bricks from fly ash-sand-lime mix (approx. 80:10:10) using an accelerator and steam curing. According to him, the capital investment needed for a 20,000 bricks/day plant (in two shifts) was about Rs 4-7 million. The presentation evoked lot of enthusiasm and many entrepreneurs showed keen interest in the CFRI process even though fly ash bricks might be slightly costlier than the available clay bricks in Bilaspur.

The second technical session was presided over by Shri S.K. Mehrotra, GGM (Operations), BALCO, in which CBRI scientists presented their paper on fly ash bricks. Other papers were relating to auxiliary and ancillary industries around BALCO. Shri Mehrotra urged that the industrialists must come forward to take advantage of the available processes.

The concluding session was presided over by Shri S.K. Chaturvedi, Divisional Commissioner of Bilaspur He appealed to the Industrial Development Corporation in M.P. to help augment production and sale of fly ash bricks. Shri Mahesh Awasthi, Joint Director of Industries, thanked the participants, particularly CFRI and CBRI scientists, for their help and cooperation.

The CFRI contingent comprised Shri D.K. Bhattacharjee, Officer-in-Charge, Shri S.K. Chakravarty and Shri B.L. Shah, Scientists, Coal Survey Laboratory, Bilaspur, and Shri D. Biswas and Shri B. Mitra, Scientists from CFRI-Dhanbad.

Seminar on Technology Upgradation in Drug Industry

The CSIR Polytechnology Transfer Centre (PTC), Hyderabad and the Small Industries Service Institute (SISI), Hyderabad, jointly organized a one-day Seminar on Technology Upgradation in Drug Industry, on 24 March 1990 in Hyderabad. Dr B.R. Sant, Scientist-in-Charge, PTC (Hyderabad), welcomed the gathering and Dr A.V. Rama Rao, Director, Indian Institute of Chemical Technology (IICT), Hyderabad, who was also the Chief Guest at the function, inaugurated the seminar. Shri K. Prasada Rao, Director, SISI, presided over the inaugural function. Dr D.R. Rao, Managing Director, Neuland Laboratories Ltd, Hyderabad, delivered the keynote address. Ten papers were presented in two technical sessions, one presided over by Dr Rama Rao and the other by Dr Sant. Shri S.L.N. Rao, Deputy Director, SISI, proposed a vote of thanks.

In his welcome speech, Dr Sant explained the objectives of the seminar, which included: (i) creation of awareness in the small scale industry (SSI) sector, about the urgent need for technology upgradation and modernization, (ii) bringing research, industrial, promotional, financial and consultancy organizations together for a dialogue, (iii) suggesting implementation plan for technology upgradation, and (iv) focussing the respective roles of SISI and PTC (Hyderabad) in bringing about modernization in drug industry. Dr Sant also mentioned the various functions of PTC (Hyderabad), e.g. promotion of indigenous technologies, counselling to entrepreneurs, and assistance in solving technological problems of SSI.

Dr D.R. Rao in his keynote address pointed out that it is due to technology upgradation that the prices of basic drugs, once three to four times higher than the international price, have come down in the country. He opined that technology upgradation does not mean extensive modifications by involving substantial investment, but small little changes in the process, which could bring down the cost of production. Improvement in the product quality is also technology upgradation. He extensively referred to his experiences in the manufacture of 16 DPA from diosgenin, betamethasone and salbutamol sulphate where gradual process improvements have been introduced to reduce the cost of production. He pointed out that technology upgradation may become necessary also due to environmental and health reasons. He advised for introduction of a proper 'systems approach' in the manufacturing field before considering technology upgradation. He also emphasized the importance of investigative approach in process optimization which relies heavily on analytical chemistry and statistical methods. Dr Rao concluded his address with the dictum 'technology upgradation is a never ending process'.

Dr Rama Rao, in his inaugural address, presented scenario of the drug industry development in the country since Independence. He said that until 1970, the drug industry in the country could not make progress mainly because of the hindrance presented by patent laws introduced during the British rule. With the introduc-

tion of new Indian Patent Law by Pt. Jawaharlal Nehru, the Indian drug industry has slowly taken a shape and gradually developed. From Rs 160 million worth of drugs exported in 1970 to the less developed countries India has achieved the distinction of exporting Rs 7000 million worth of bulk drugs and 3000 million worth of formulations to the developed countries, including USA and USSR. The enterprising ability of the Indian entrepreneurs, favourable conditions in the international market and the present patent system are all responsible for achieving the above target, Dr Rama Rao said. He strongly felt that for further development of the Indian drug industry and to withstand the international market competition, the existing patent laws should continue for atleast another ten years. Stating that India has tremendous potential in the drug industry, Dr Rama Rao stressed the need to concentrate on invention of drugs. He said that IDPL, established in the early sixties, gave a boost to basic drug industry and Hyderabad became country's major basic drug centre. Although nearly 9000 small scale units are in existence in the country, Dr Rama Rao deplored that the majority of them do not have the basic quality control facilities. Many of them are duplicating the products based on the same technology. The financial corporations are financing such units without realizing the problems, which is not only causing depletion of the resources but also creating adverse effects on the drug industry. Dr Rama Rao felt that the drug industry should come up based on the country's needs and the opportunities in the international market. He further stressed that any drug industry which starts in the SSI sector should not remain stagnant but should develop over a period of time to a medium-large industry if not a very large industry. He also advised for a common effluent treatment plant for the small scale drug industrial units in a region, which is presently in practice in Gujarat as per his advice.

The IICT Director observed that despite fairly good resources, scientific manpower and talented technologists, India has not developed a single outstanding drug. He emphasized the need for right and dedicated people in industry and in R&D. He also stressed the need to strengthen quick and reliable quality control testing facilities in the SSI sector. Towards the end of his address Dr Rama Rao illustrated through slides the new developments, particularly the R&D work at IICT in the area of drugs.

Shri K. Prasada Rao in his presidential remarks explained the role of DCSSI in technology upgradation, the various incentives and facilities offered by the government and the assistance given by SISI, Hyderabad.

Following papers were presented in the two technical sessions: Need for technology upgradation in bulk drug industry (Dr D.R. Reddy, M/s Standard Organics Ltd, Hyderabad); Role of CDRI in technology upgradation in drug industry (Dr C.M. Singh, CDRI, Lucknow); Role of quality control in upgrading the drug and pharmaceutical industry (Shri J.B. Kulkarni, M/s Parke-Davis, Hyderabad); Role of financial institutions in the development of drug industry (Shri V. Raman, SBH, Hyderabad); Role of APSFC in the development of drug industry (Shri O.P. Gupta, APSFC, Hyderabad); Role of consultancy organizations in drug industry (Shri V.N. Murthy, APITCO, Hyderabad); Role of SBI in the development of drug industry (Shri Vijay Kumar, SBI, Hyderabad); Upgradation and diversification of process technology with reference to process and equipment planning (Shri Sirish, M/s Dhopeshwarkar, Hyderabad); Role of Chemexcil in drug industry (Shri M.R. Deshpande, Chemexcil, Bombay) and Status paper on drugs and pharmaceuticals industry in India and Andhra Pradesh (APSSIDC, Hyderabad). □

CFTRI's Package of Escort Services

A unique package of escort services entitled 'CFTRI Technology Update Service' for boosting food processing industries has been launched recently by the Central Food Technological Research Institute (CFTRI), Mysore, to guide and assist entrepreneurs, executives, promotional agencies and policy makers involved in the development of food processing industry in the country.

The food industry has acquired an important role in the natural development plans in terms of food security employment generation and export earnings. With the formation of exclusive ministries for Food Processing Industries and Small Scale, Agro and Rural Industries at the central and state levels and announcement of the various incentives for export of processed foods and promotion of agro-based food industries, the growth of food processing units—small and big—is on the upsurge in the country. Various state government agencies are also displaying abundant interest and enthusiasm in identifying and establishing appropriate agro-based industries to harvest potential local food resources, to generate employment at the rural and semi-urban areas, and to provide remunerative prices to farmers. Against this backdrop, in order to sustain and channelize abundant interest generated and to boost the initiative for establishment of right type of food processing industries with strong technical backup, CFTRI, with a treasure-house of expertise and experience available at its disposal for promoting food processing ventures, offers a host of more than 25 types of escort services under the new package programme.

It broadly covers preparation of technology profile reports on agro-resource studies, reports on export market for specific products, preparation of special reports based on literature survey, international price statistics, conceptual reports for new ventures

and diversification, specific technology assessment reports, project evaluation for financial institutions, preparation of state-of-art reports, supply of CFTRI publications, etc., at nominal rates.

In addition to these services, analytical quality testing services, renting out pilot plant facilities and use of highly sophisticated equipment, not available elsewhere, and special training programmes are being arranged in all the areas of food science and technology on priority basis at affordable rates. Small scale industries are offered special concessions and facilities. Some of the periodicals, such as *Development News Bulletin, Techno-Economic News, Food and Allied Industry News*, as well as technical advisory service on CFTRI technologies are also being offered to the clients free of cost, as a part of package. CFTRI's package of services is a noval step in fortifying the efforts of the country in marching towards progress in the food processing sector, thus removing a major constraint, viz, lack of lowcost technical services for the cottage/small scale industrial units in the country. Interested parties may register themselves as subscribers and obtain further details from the Chairman, Technology Application Division, CFTRI, Mysore 570013. □

New Entrepreneurial Opportunities in FRP Products: Seminar at CGCRI

The Central Glass & Ceramic Research Institute (CGCRI), Calcutta, organized a seminar on New Entrepreneurial Opportunities in FRP Products during 22-23 March 1990, under the sponsorship of the Department of Science and Technology. The seminar was organized with a view to creating awareness among the prospective entrepreneurs with S&T background, about the prospect of FRP industry in the country in general and in the eastern region in particular, and thereby motivating them to set up small scale FRP units for gainful self employment. It was attended by 200 delegates, of which 145 represented different organizations and 10 were prospective entrepreneurs. An exhibition displaying a wide range of FRP products from various organizations, was also organized on the occasion.

Welcoming the participants, the CGCRI Director, Dr B.K. Sarkar dwelt on the growing importance of FRP products, the need for new ventures in diverse areas and the efforts made by the Composite Division of his institute in conducting successful training programmes on manufacturing FRP products in collaboration with various voluntary organizations. He invited the entrepreneurs to utilize the services of the well equipped Composite Division to their benefit.

Dr B.K. Sarkar, Director, CGCRI, welcoming the participants at the seminar on Entrepreneurial Opportunities in FRP Products

Shri M. Bandopadhyay, Principal Scientific Officer, DST, the guest of honour on the occasion, highlighted the role of DST in encouraging entrepreneurship development programmes in various fields and the collaborative efforts already made by DST and CGCRI in the area of FRP.

Prof. B.D. Nagchoudhury, the chief guest, highlighted the emergence of FRP as a versatile material which is expected to play a major role in the industrialization of the country in the years to come. He praised DST and CGCRI for their efforts in this vital area and expressed hope that the tempo of such collaborative activities would be intensified further in future.

The deliberations of the seminar were held in four technical sessions; the lectures were followed by question-answer sessions.

In the concluding session, Prof. P. Ghosh, Department of Plastics & Rubber, Science College, Calcutta University, while summing up opined that the seminar was highly successful as it provided the much needed forum for an effective interaction among the FRP manufacturers, users and the prospective entrepreneurs. Topics of the lectures, according to him, were in tune with the objective of the seminar and the deliberations, supported by audiovisual aids, were able to evoke the desired interest among the delegates. He also emphasized that while venturing on a FRP project, cost benefit analysis is of prime importance for its viability. □

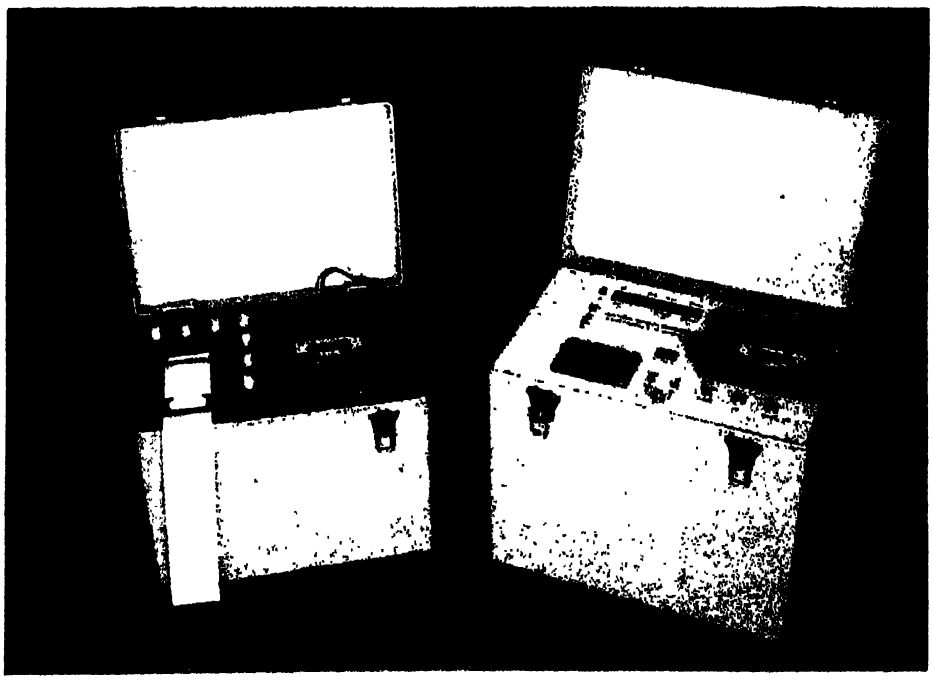
CSMCRI's Reverse Osmosis Membranes exported to Thailand

The Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, had donated in March 1989 two reverse osmosis desalination plants, one stationary plant of 30,000 litres/day capacity and the other a mobile plant of 15,000 litres/day capacity, to the Government of Thailand, for converting brackish water into potable water. Based on the successful performance of these plants, the Thailand Government has now placed order with NRDC of India for the supply of 4000 sq.m. of RO membranes at a total cost of $ 1,60,000. The supply of the membranes is to be effected over a period of one year in four quarterly instalments. The first lot was delivered on 26 March 1990. It is understood that the Thailand Government would install 20 RO desalination plants employing CSMCRI membranes at different places for supplying good quality potable water to the local community. □

Membranes for reverse osmosis plants in Thailand

Microprocessor-based Digital Cassette Seismograph

The Central Scientific Instruments Organisation (CSIO), Chandigarh, has developed a Digital Cassette Seismograph (DCS) based on C-MOS technology in standard configuration, which records data of 3 channels at a rate of 100 samples/s/channel. DCS is meant to produce a magnetic tape record of seismic events as detected by seismometers, geophones, servo accelerometers, or virtually any other sensor with a DC output in the ± 5 V range. Its main features include: 112db dynamic range, 5 pole Butterworth filters, manual gain ranging, short term average and long term average ratio triggering, energy level actuated triggering, pre-event data duration of 3.2s, post-event programmable delay of 15, 50 & 100 s, precision internal clock and continuous time recording with data. It is versatile, portable and can be field operated rechargeable car batteries.



Microprocessor-based digital cassette seismograph

During operation, DCS continuously amplifies, filters, and converts the sensor output into 12 bit digital format and stores it in memory alongwith the internal time, gain of channel, event count and user supplied station serial number identification code. When the triggering criterion is satisfied, the instrument begins recording the data on a cassette tape from the cyclic RAM memory. The pre-event digital delay ensures that the entire event including the first P wave arrival is recorded.

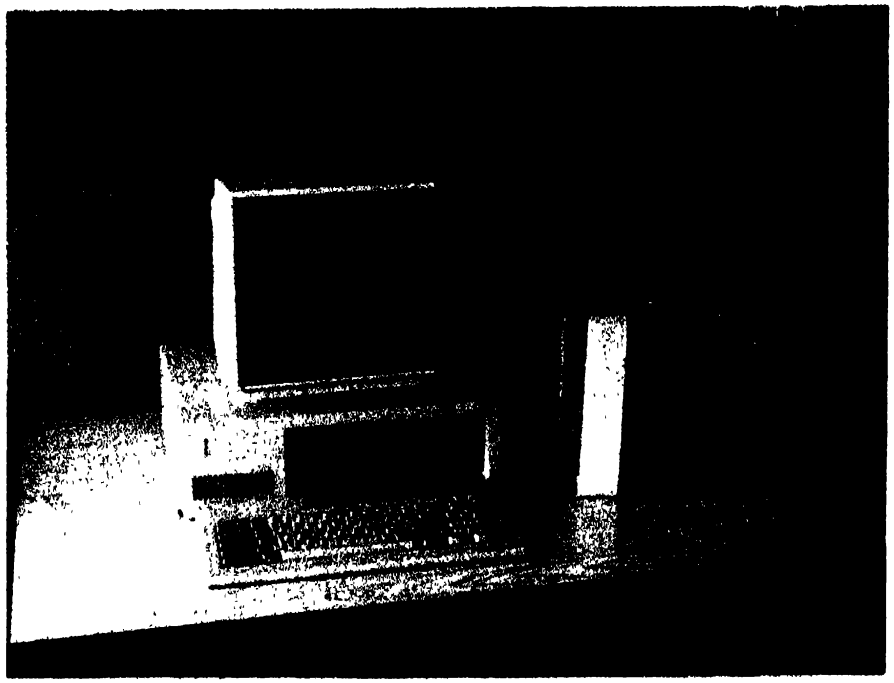
DCS has two triggering criteria, short term average (STA) to long term average (LTA) ratio triggering and energy level triggering. The STA/LTA ratio trigger continuously computes the short term average and long term average.

When the STA exceeds a selected multiple of LTA, DCS is triggered. The energy level trigger continuously compares the input signal and when it exceeds the preset threshold, DCS is triggered. The triggering parameters and set point are set from the front panel.

The instrument consists of the following modules:

Input amplifier and signal conditioner module

1. A/D converter module
2. Microprocessor module
3. STA/LTA ratio trigger module
4. Seismic timing module
5. Data transfer module
6. Tape deck-MFE-250B interface module
7. Front panel control/display module.



Digital seismic data retrieval system and playback plotter

Digital Seismic Data Retrieval System and Playback Plotter

Developed by the Central Scientific Instruments Organisation, Chandigarh, the Seismic Playback System is a data plotter to provide convenient testing, calibration and playback of seismic data recorded on microprocessor based Digital Cassette Seismograph. Continuous single channel data are plotted on heat sensitive strip chart paper having 50 mm channel width.

Cassettes with seismic event data may be interrogated and immediate data plots obtained for rapid analysis. This system is compatible with 3 channel system and provides playback selection for analog or digital inputs, Numeric identification sequence is edge-printed simultaneously with the analog plotting. This sequence provides timing information, recorded gain, identification codes, and auxiliary data. Timing marks, either ATA or one second marks, are edge-printed on the opposite margin.

Specifications

Tape deck	: MFE 250-B digital cassette
Digital format	: 2 track
Tape speed	: 6 in/s
Bit rate	: 800 bits/s
Bit density	: 800 bits/in
Indicators	: data present (light)
Plotter	: single channel 50 mm wide
Plotter frequency response	: 50 Hz (galvanometer)
Chart controls	: speed 1 or 2 cm/s (selectable)
Printer	: high reliability thermal printer with no moving parts
Calibration	: switch selectable zero and 0.5 F.S. input (static) 0.5 Hz squarewave at ± 0.125 F.S. (dynamic)
Time marks	: switch selectable for ATA or one second marks
Channel select	: switch 1-3
Plotter select switch	:calibration, direct analog, direct 3 channel digital 3 channel tape input

The playback plotter can be directly hooked up with any IBM PC-compatible personal computer through RS-232 interface. The data recorded on the cassette can be transferred over to floppy disk or hard disk in computer compatible format for their subsequent processing on the main frame computer.

The total system has been thoroughly tested by the eminent users like IMD-New Delhi, Earth Sciences Department of Roorkee University and National Geophysical Research Institute, Hyderabad. The total system has been handed over to these users for the collection of seismic data from the field and observatory and its performance has been found to be satisfactory.

The CSIO developed system costs considerably much less than the imported one whose current price is approximately 1.2 million. This system has been developed for the first time in the country and is very strategic in nature to collect vital data. There are approximately forty eminent user's of this instrument in the country, including the Defence. □

RRL, Bhubaneswar celebrates Its Foundation Day

The Regional Research Laboratory (RRL), Bhubaneswar, celebrated its twenty-sixth Foundation Day on 13 April 1990. Dr V.K. Gaur, Secretary, Department of Ocean Development, Government of India, delivered the Foundation Day lecture on the Antarctica Expeditions. In his lecture he said that an indefinite moratorium

Dr V.K. Gaur, Secretary, Department of Ocean Development, delivering the Foundation Day lecture at RRL-Bhubaneswar

on mineral exploration would be established in the Antarctic region. Stating that the spreading 'ozone holes' in the upper atmosphere over the region have made the territorial claims of several nations with respect to Antarctica irrelevant, Dr Gaur added that it has only reminded mankind of its common responsibility in protecting the environment. The Indian scientists have conducted gravity and magnetic field surveys in Antarctica and would be exploring the temperature patterns in the ice rocks at different depths soon, Dr Gaur said. He also released the annual report of the laboratory for the year 1989-90.

Welcoming the gathering, Prof. H.S. Ray, Director, RRL (Bhubaneswar), highlighted the major R&D work carried out at his laboratory during 1989-90. He informed that RRL had undertaken nine sponsored/collaborative/consultancy projects for different organizations in addition to other important continuing projects. A new project for extraction of cobalt and nickel from the Sukinda Valley deposits was started with support from the Government of West Germany. Preparation of special materials using plasma technology, hydraulic transportation of coal and other minerals and development of flotation column for fine coal recovery are among other major projects which registered significant progress. A Memorandum of Understanding executed with the Orissa Industrial and Technical Consultancy (ORITCO) would help identify entrepreneurs for effective transfer of technologies developed by the laboratory. He said that the laboratory would give renewed thrust to the major R&D programmes. Under the programme of setting up national demonstration facilities on agglomeration, a briquetting press of one tonne/day capacity had been installed by the laboratory at the ferro chrome plant of the IDC of Orissa Ltd, at Jajpur Road. About 50 tonnes of chromite briquettes were prepared by using this press and charged at the rate of 20% with the lumpy ore in the ore smelting furnace for production of silico-chrome. The trial campaign was successful but the quantification of benefits derived would be assessed after more trials with higher percentage of briquettes in the charge, Prof. Ray said. □

PROGRESS REPORTS

RRL-Bhubaneswar Annual Report: 1989-90

The Regional Research Laboratory (RRL), Bhubaneswar, has brought out its annual report for 1989-90. The major R&D activities/achievements of the laboratory, covered in the report, are summarized here:

The chrome ore and associated rock samples of Sukinda Chromite Mines, Orissa, were examined for their size analysis, spinel composition, nickel content, including mineralogy and texture. A number of visits to the Sukinda mining area were undertaken with a view to assessing the availability of best possible grade of Ni-bearing overburden material from the existing mines of TISCO (Tata Steel) and Orissa Mining Corporation (OMC) for the proposed pilot plant. Suitability of making good portland cement from the limestone fines of Lambidhar deposit (Uttar Pradesh) was established using simple pan roasting technique. Basic studies relating to geology and geochemistry of vanadium bearing titaniferous magnetite of Mayurbhanj District (Orissa) were completed. Besides, testing of ore samples, sinters, coal ash, etc. were undertaken for the mineral industries and mining organizations.

The new projects initiated in the area of Mineral Beneficiation Group during the year are: (i) Recovery of molybdenum from Rakha copper concentrate for M/s Hindustan Copper Ltd (HCL); (ii) Recovery of carbon lost in tailings of West Bokaro (for TISCO/Tata Steel); (iii) Investigations for reduction of silica and alkalies in the limestone from Nandini quarry (for SAIL, Ranchi) and (iv) Reduction of iron in Mn ores (for Sandur Manganese-Iron Ore Ltd). Studies were also initiated on the utilization of sludge from sponge iron plant at the instance of M/s IPITATA Sponge Iron Limited. Investigations on: (a) response to beneficiation of coking coal after crushing to finer sizes and development of a frother system for coal flotation, both sponsored by Central Mine Planning and Design Institute Limited (CMPDIL) and (b) beneficiation studies on Bolani iron ore fines sponsored by SAIL, taken up during the previous year, were completed and reports submitted to

the sponsors. Techno-economic feasibility studies on coal beneficiation for power generation at Talcher, taken up as consultancy assignment for M/s Orissa Power Generation Corporation (OPGC) in association with Metallurgical and Engineering Consultants (MECON), were completed and report submitted. Work on establishment of a demonstration flotation column at Sudamdih (Bihar) in association with CMPDIL and MECON was in progress.

In the area of Pyrometallurgy, agglomeration of chromite fines, extraction of nickel and cobalt from chromite overburden and extraction of metal values from sea bed manganese nodules were the major R&D activities during the year. Under the programme on setting up of National Documentation Facilities on Agglomeration, a briquetting press of 1 tonne/day capacity has been installed at Ferro-Chrome Plant, Jajpur Road (Orissa). About 50 tonnes of chromite briquettes were prepared utilizing the press and were charged at the rate of 20% with the lumpy ore in the arc smelting furnace for production of silico-chrome. The trial campaign was successful but the quantification of benefits derived would be assessed after few more trials with higher percentage of briquettes in the charge. The consultancy and sponsored projects completed during the year include: (i) Studies on Drop Shatter Test of South Balanda Coal for Fertiliser Corporation of India Ltd (FCI), Talcher (Orissa), (ii) Characterization and Metallurgical Testing of Rajhara, Kohan Mahamaya Mines (Madhya Pradesh) for Bhilai Steel Plant, and (iii) Filtration of Chromite Filter Cake of Charge Chrome Plant (2nd phase of work) for Orissa Mining Corporation Alloys Limited (OMC Alloys). The studies related to production of ferro-manganese by aluminothermic method, a consultancy project for Manganese Ore (India) Ltd (MOIL), Nagpur, was in progress. The work on reduction roasting of manganese ores in pan roaster for production of electrolytic manganese dioxide/electrolytic manganese metal (EMD/EMM) was completed. One of the major activities undertaken during the year was on modification of the existing Multiple Hearth Furnace (MHF) with a view to making it suitable for reduction roasting studies with particular reference to reduction roasting of chromite overburden and sea bed manganese nodules. Simultaneously, extensive laboratory studies on reduction roasting of chromite overburden for optimization of basic parameters were being carried out. The roasting of chromite overburden is an important step for the development of nickel technology under the Indo-FRG collaborative programme, while the studies on manganese nodule roasting have been undertaken in association with National Metallurgical Laboratory (NML), Jamshedpur.

The Hydro & Electrometallurgy Group pursued several important projects in collaboration with Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ), GmbH, West Germany; Department of Ocean Development (DOD), Government of India; Hindustan Zinc Ltd (HZL); Hindustan Copper Ltd (HCL); and National Council for Cement and Building Materials (NCCBM). These projects accounted for a major part of laboratory's total external support. The major projects of this group are: (i) Extraction of metals from Indian Ocean nodules, which has been accorded mission project status by CSIR and (ii) a new project for extraction of cobalt and nickel from Sukinda deposit, started with support from GTZ, GmbH, West Germany and CSIR. Under this project, it is envisaged to develop a metallurgical process and test it at the laboratory's test plant. This project would involve about 900 scientist man-months and about Rs 40 million for equipment and chemicals. The other major project in the area of Hydro & Electrometallurgy was process development for the extraction of copper, nickel and cobalt from the manganese nodules. Under this project, purification of solution before electrowinning of nickel and copper was standardized. Conditions for precipitation of cobalt were also established. The consultancy projects carried out by the group included: (a) solvent extraction-electrowinning of cobalt; (b) pressure leaching of zinc leach residue; (c) bio-leaching of limestone; and (d) solvent extraction of copper, nickel and cobalt from solutions.

Special Materials Division made considerable progress in harnessing plasma technology in smelting, melting, alloying and various material preparations. Different types of thermal plasma reactors using graphite electrodes were developed for plasma smelting of ore fines, melting and alloying as well as plasma dissociation of ore minerals like zircon. Ferrochrome (Fe-Cr), ferrotungsten (Fe-W) were prepared by direct smelting of ore fines with different carbonaceous reductants. SG iron was prepared by smelting of blue dust under a consultancy project of M/s National Mineral Development Corporation Ltd (NMDC), Hyderabad. Iron-aluminium-carbon system was studied using plasma melting technique and different important compositions relating to structural, magnetic and cutting tool applications were being developed. Exploratory investigations on plasma dissociation of zircon and stabilization of zirconia were made with encouraging results. New composition, $Ba_{(1-x)} Sr_x TiO_3$ with improved dielectric properties was developed for capacitor applications. Al-SiC particulate composites were being investigated. Basic studies on characterization of superconductors by new techniques like X-ray emission and photo-luminescence were successfully carried out.

The Design and Project Engineering Group completed the pilot plant studies on unwashed coal samples of New Majri coal fields, required for the detail project report preparation by M/s Engineers India Ltd (EIL),

New Delhi, for transportation of coal through pipelines covering a distance of 40 km. Acoustic burner technology developed by the group was successfully implemented by TISCO (Tata Steel), Jamshedpur, in their mixer unit. A demonstration unit for the removal of phenols and cyanides from effluent waters of steel plant was being set up at Rourkela Steel Plant. The technology of multifuel domestic chulha was referred to the Department of Non-conventional Energy Sources (DNES), Government of India, for its propagation throughout the country under the Department's national programme on improved coke stove.

In the area of Inorganic Chemicals, work was in progress on: (a) development of catalysts, and (b) complete utilization of ferrochrome slag for the recovery of inorganic chemicals of industrial importance. Sponsored work on the development of multicomponent bismuth molybdate catalysts was nearing completion. In addition, extensive tests on reformation catalyst were carried out in high pressure twin reactor for the conversion of cyclohexane to benzene. A method was developed for the recovery of cobalt from spent hydrodesulphurization catalyst. Interesting results were obtained with samarium oxide doped lead oxide for methane conversion. A novel technique for oxidation of sulphide minerals with manganese dioxide in dilute acid medium was developed for the preparation of several metal sulphates. As a part of the general programme of work on fertilizers from wastes, studies on the preparation of composite fertilizer from ferrochrome slag and phosphatic rock were being carried out. These multi-component fertilizers contain magnesium, calcium and phosphate values and other essential plant nutrients.

The processes for the production of saponin from soapnuts, 2,4-dihydroxy quinoline and nickel azo yellow developed by Forest and Marine Products Group were ready for commercialization. Experiments were carried out for the preparation of androstadienedione (ADD), using 16-dehydro pregnenolone acetate (16-DPA) as raw material, as a part of the programme on 19-nor steroids, which has been included in the area of Drugs and Vaccines under CSIR Thrust Area Programme. Work was also carried out for developing economically feasible processes for waxes and sitosterols from pressmud and some of the extracts from marine organisms exhibited activity in the preliminary screening. Work was in progress on development of reagents for metal ion extractions and on a process for oxalic acid from bamboo dust produced by paper industries.

In the area of Aromatic and Medicinal Plants, agronomical and plant improvement studies were taken up as a part of CSIR Thrust Area Project. Improved strains of palmarosa developed by the laboratory were taken up for field trials. Drought resistant strains of cymbopogon species developed through chemical mutagens were planted for progeny evaluation and stabilizing the characters. Elite cinnamon plants were multiplied and planted in two different locations in Orissa for multilocation performance evaluation and segregation pattern study. Introductory trials with three exotic fast growing tree species were made for biomass production. Plant resources survey of Koraput District was carried out and over 200 plant specimens were collected, identified and incorporated in the Herbarium. About 50 ethnobotanical notes were gathered with the help of local tribal people. A Rs 6.78 lakh consultancy project on 'Preparation of a Comprehensive Flora of Orissa' was sponsored by the Orissa Plantation Development Corporation Ltd, a Government of Orissa Undertaking.

During the year, 70 research papers were published and 50 technical papers were presented in symposia/seminars.

RRL-Jorhat Annual Report: 1988-89

The Regional Research Laboratory (RRL), Jorhat, has brought out its annual report for 1988-89. According to the report, the laboratory pursued work on drinking water, wasteland development, bioinsecticide against mosquito, popularization of agrotechnologies, lowcost housing and development of domestic appliances under the societal and national mission programmes. Under the National Mission on Drinking Water, RRL-Jorhat is working on the evaluation of drinking water qualities of three districts of north eastern region and feeding the information on remedial measures to the respective government public health departments. The laboratory provided the cultivation technology of economic plants in the Karbi Anglong district of Assam, particularly in the Manza area which is one of the most backward areas of the district. An area of about 120 ha was covered under these plantations. Studies on fibre reinforced materials using natural and synthetic fibres, and bricks from available inferior soil were in progress.

Basic research carried out by the laboratory related to: multiphase reactors, polymer mineral interaction, characterization of high silica aluminosilicates, mitomycin analogues, hydrocarbon transportation in microorganisms, ethanol fermentation, microbial transformation of sterols, kinetics of anaerobic digestions, synthesis of artemisinin analogues, fast growing plants for paper making, tissue culture of economic plants, plant breeding, cyto, patho and physiological aspects of economic plants, environmental pollution aspects for muga silk worm and its food plants, synthesis of antimicrobial chemicals, crude rheology and thermal conditioning, insecticidal compounds, growth promoting substances, earthquake hazards evaluation and predictions, etc.

Under its programme 'R&D for industry', the laboratory carried out

studies on synthetic organic polyelectrolytes, industrial filter papers, printing ink, ceiling boards, gummed paper tape, computer aided studies, improvement in curing technology for cold-bonded pelletization, drugs like Pentazocine, Nitrazepam, geomicrobiological and geochemical prospecting for petroleum, fedbatch studies for biogas production, pesticides like Abate, Acephate, Ediphenphos and Oxydemeton.

Parameters were optimized for making deoiler on pilot plant scale (100 kg/ batch). Four tonnes of the product was prepared at the instance of ONGC and OIL and the same was tested at different oil fields of the region. The process was then licensed to Poly Products (Chemicals Division), Guwahati, for commercialization.

A formulation for making gummed paper tape was optimized, first on the laboratory scale and then on a commercial plant. One party, Chorus Enterprises, Uzanbazar, Guwahati, went into production based on the laboratory's formulation and technical assistance.

A draft TEFR for the proposed pesticide complex for Bangladesh, to manufacture DDVP and Phosphamidon in an integrated plant was prepared jointly by RRL-Jorhat and IICT-Hyderabad. The assignment was sponsored by the Ministry of External Affairs, Government of India, through NRDC. The draft was submitted to NRDC for follow-up action.

The final report on the project 'Optimization and transportation of high waxy crude oils through submarine pipelines' was prepared and submitted to ONGC (BOP).

The know-how package on the diosgenin process based on pilot plant level investigations including scale up studies was handed over to the Tripura Forest Development & Plantation Corporation Ltd (TFDPC), Agartala. The basic design for 10 tonnes/annum diosgenin plant for TFDPC was also taken up and the TEFR was handed over.

The preliminary work on the basic design for the proposed 30 tonnes/ annum caffeine plant of the North East Caffeine Industries (Pvt) Ltd, Jorhat, was under progress.

A modified method to prepare concentrated solution of hydroxy aluminium was developed and scaled up to 200 litres/batch. As per the OIL, Duliajan's order, 4 kilolitres of the product produced at the laboratory's pilot plant, was sent to Duliajan for field trial.

Work relating to the hazard studies and risk analysis for the Hazira Gas Processing Complex, Hazira, was completed. Investigations on the maximum credible accident analysis of the Manali industrial area was completed and the report was submitted to the Tamilnadu Pollution Control Board, Madras.

Geomicrobiological survey in the north bank of the Brahmaputra valley around Jonai in Lakhimpur district was conducted with the support of OIL, Duliajan, using the technique developed at RRL-Jorhat. At a particular location, high level of microbial indicators was recorded which coincided with the positive indications from seismic studies carried out by OIL, Duliajan.

RRL-Jorhat, in collaboration with NGRI-Hyderabad, continued to work on expansion of the seismic surveillance network in the north eastern region.

During the year, eight processes of the laboratory were licenced through NRDC and released to eight parties. Four more processes were released directly by the laboratory to nine parties. Four new processes, i.e. (i) Industrial filter paper, (ii) Printing ink, (iii) Ceiling board, and (iv) Gummed paper tape were developed and made ready for release to entrepreneurs for commercialization. Six new parties went into production for the first time. One party from Indonesia also started production of water filter candles based on RRL's know-how.

During the year, 52 research papers were published, three patents were accepted and seven more were filed. The laboratory earned Rs 5.908 million through consultancy, grant-in-aid, analytical/testing services and sponsored projects. □

DEPUTATION BRIEFS

Dr S.B. Mahato

Dr S.B. Mahato, Scientist, Indian Institute of Chemical Biology (IICB), Calcutta, visited the Walter Reed Army Institute of Research, Washington DC, USA and Strathelyde University, Glasgow, UK, for a month from 15 April 1990, under the IICB's ongoing UNDP project: Molecular biology and biotechnology applied to the study of parasites. Dr Mahato, who is involved in this project in the area of chemotherapy of leishmaniasis, discussed and exchanged views with scientists in those two laboratories, who are engaged in similar area of research. His discussion included: synthesis of better antileishmanial drugs for combating kalaazar, the visceral leishmaniasis endemic in certain regions of eastern India and the possibility of using non-ionic surfactant vesicles, niosomes, as successful carriers for urea stibamine, an antileishmanial drug synthesized in the laboratory for real therapeutic advantages, i.e. better efficacy and less toxicity. □

NTS FILED

287/DEL/90: A process for the preparation of polymeric sulphonates useful as surfactant from cashewnut shell liquid or Bilawan nut liquid, T.C. Phatak and S.K. Agarwal—Central Building Research Institute, Roorkee.

288/DEL/90: A process for the removal of ultrafine carbonaceous impurities from processed china clay by froth flotation, P. Raghavan, S. Chandrasekhar, M. Lalithambika, C.P. Sivam, A.D. Damodaran—Regional Research Laboratory, Trivandrum. □

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Commercial scale flotation cell, commissioned by RRL-Trivandrum, for removal of graphite from poor quality clays to make them suitable for use in quality paper production. A report on the laboratory's R&D activities during 1989-90 appears on p. 167

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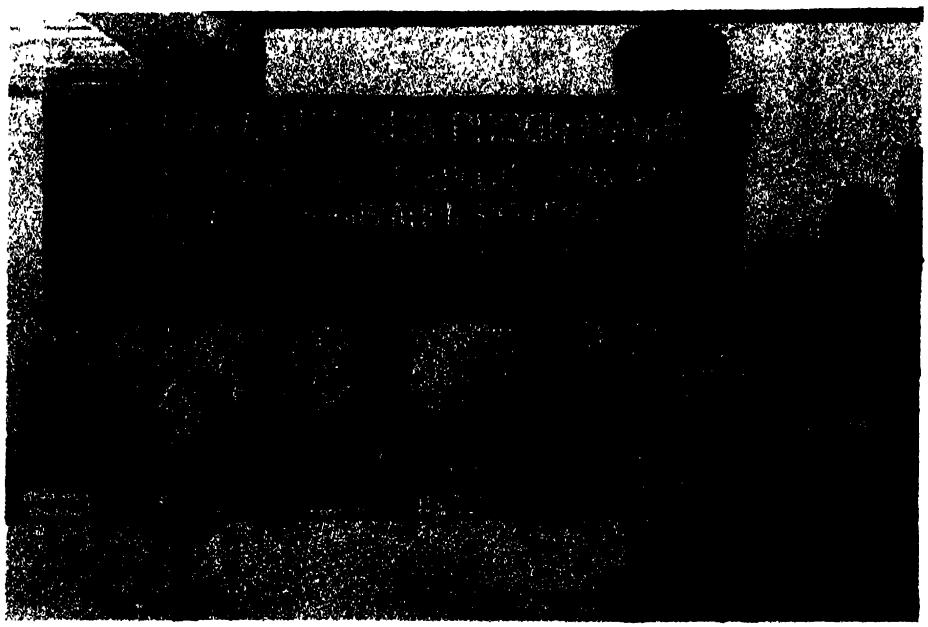
NRDC Training Programme on Management of Technology Transfer, Patents and Information Systems

The National Research Development Corporation of India, Regional Research Laboratory (RRL), Trivandrum, and STED, Kozhikode, jointly organized the 16th NRDC Training Programme on Management of Technology Transfer, Patents and Information Systems, during 4-8 June 1990, in Trivandrum. Twenty-five participants comprising scientists, engineers, entrepreneurs, teachers, administrators, consultants, managers and financial analysts drawn from research institutes, industries, universities, financial institutions and consultancy organizations and industry departments, attended the training programme. The main objective of this training programme was to impart latest knowledge on theory and practice on technology management.

Shri V. Ramachandran, former Chief Secretary, Government of Kerala and presently Chairman of the Kerala State Industrial Development Corporation (KSIDC), inaugurated the programme. In his inaugural address, he observed that India, being a late starter in industrialization and development of Science and Technology, has the advantage of skipping the learning steps experienced by the developed countries. However, the country has got to acquire enough skills to understand the theory and practice of science, technology, economics and management. Or else, it may face the fate of Latin America. Though, India developed a wide network of S&T infrastructure in the last four decades, it failed to coordinate them on common objectives. Coordinated efforts was the key to success by the West. Some might say that the failure to coordinate efforts in India was owing to the bureaucratic set-up in the government-controlled institutions. But Shri Ramachandran opined that it was mainly due to the lack of confidence and initiative to take risk, and poor management. A survey of major projects around the world indicates that only 20% of projects were implemented by resource allocations. And those were the projects which were conscious of risk management. Economy is changing very fast and world market is getting globalized. So, one should assess and manage risk at every stage of project implementation. He wished that NRDC would enlighten the Indian S&T and industry in risk assessment and management. Risk management should be studied and practised as an integral part of management of technology development and transfer. People in all walks of life must be trained in the discipline of risk management. Unless risk management is taken care of, integrity of technology cannot be ensured.

Presenting his keynote address, Dr R.A. Rao, General Manager, NRDC, New Delhi, said that way back, NRDC set up a Centre for Technology Transfer, which in the course of time has taken the shape of Centre of Informatic Systems with a focus on information dissemination and training. This Centre conducted 15 training programmes in the Seventh Five Year Plan period. The sixteenth training programme was the first one in the Eighth Five Year Plan period. Dr Rao remarked that there are three major sources of technology, viz from developed countries through foreign collaborations, from developing countries possibly through technical cooperation, and through indigenous development. Foreign collaborators are generally unwilling to part with their know-why. Further, these collaborations make a country dependent on foreign technologies. This stagnates absorption and innovation by indigenous R&D efforts since the foreign collaborations are made with unequal tie-ups and restrictive clauses.

Dr Rao further said that during the post-independent period, India has set up so far 150 universities, 42 national labs under CSIR, 42 defence research organizations under DRDO, 26 medical research institutes under ICMR, 39 research centres under ICAR and many more under Departments of Space, Atomic Energy and Industries. This has improved India's bargaining capacity with foreign collaborators. And now, India is considered as the most developed country among the developing countries. NRDC has played a catalytic role in upgrading India's S&T capabilities by promoting transfer and utilization of indigenous technologies even through equity participation and risk



Dr R. A. Rao, General Manager, NRDC, giving his keynote address at the 16th NRDC Training Programme. Seated on the dais (from left) are: Dr C. S. Narayanan, RRL-Trivandrum: Shri V. Ramachandran, Chairman, KSIDC: and Shri I. R. Kumar, Programme Director and Deputy General Manager, NRDC

financing and also through participation in Technical Evaluation Committees set up Government of India.

He cited the cases of Amul milk powder developed by CFTRI, Mysore and promoted by the Anand-based Cooperative Milk Production Centre, Swaraj Tractor developed by CMERI, Durgapur and promoted by the Punjab Tractors Limited, as success stories of technology development and transfer from indigenous capabilities. From the stage of promoting indigenous technologies through vertical transfer from lab to industry, NRDC has now reached a level where it is capable of promoting horizontal transfer of technologies from one industry to another and also from India to other developing and developed countries, Dr Rao added.

The training programme consisted of lecture series by experts drawn from research institutions, industries, government departments, financial institutions, consultancy organizations and educational institutions. It was further supplemented by group discussions, factory visits and project reporting by the participants.

Dr P.V.S. Namboodiripad, Managing Director of the Hindustan Latex Limited, Trivandrum, shared his experiences in Management, Assessment and Sharing of Indigenous Technologies. According to him, the management and assessment of technology varies in accordance with the levels of development. A manager is one who is a creator, implementer, modifier and diversifier. In India, Dr Namboodiripad said, technology transfer mechanisms are more procedure-oriented than result-oriented. This trend should be reversed. The drafting of Memorandum of Understandings (MoU) should be made more functional by incorporating more technical parameters which would have to be achieved. Transfer of technology should attempt to match the level of technologies with the skills of entrepreneurs. And the technology package should be comprehensive and up to date with respect to technical and price parameters. According to him, failures of Indian technologies are mainly due to their half bakedness. Time value of technology development and transfer is one of the prime factors, which is mostly ignored. He pleaded for establishment of Technology Development and Transfer Centres for bridging the gap between indus tries and R&D centres.

Shri I.R. Kumar, Deputy General Manager (Informatics). NRDC, and the Programme Director of this training course, initiated the session on 5 June. The topic he dealt with was on the Sources of Technological Information. He said that today, information is synonymous with technology which can be commercialized. Its importance has been well emphasized in the Technology Policy Statement (TPS) of 1983 of the government. Today, technical information being the base of S & T strength of a country, Shri Kumar urged for systematic generation, preservation, management and dissemination of S&T information.

Dr V. Govindarajulu, Local Coordinator of the training programme and Scientist, RRL Trivandrum, highlighted the importance of technological forecasting in accomplishing technological and economic self-reliance. He said that self-reliance must be distinguished and differentiated from self-sufficiency. Self-reliance as a concept focusses on indigenous S&T, industry and economic capabilities while at the same time demands for integration with world economies on competitive terms. Self sufficiency as a concept has become a dogmatic one in absolute terms and hence a barrier to India's integration with world trends. Technological forecasting as a tool of planning helps evolve alternative strategies for investment decision. Lack of technological forecasting and assessment has led India to do imitative research which is cost-ineffective. On the other hand, proper forecasting assesses risks and probability of occurrence of a technological event. Planning is an organized foresight into future. And forecasting as science of future studies helps sharpen the planning process and provides alternative strategies. Failure to adopt forecasting has been causing havoc to national economy in the form of floods, cyclones, droughts, famines, accidents and so on. Hence the need for organized efforts to integrate technological forecasting with technology assessment and transfer for national self-reliance.

Shri K.D. Namboodiripad, Project Director, STED, Kozhikode, presented an overview of the role played by STED project, funded by DST, in promoting appropriate technologies in Kerala. The promotional role of STED includes propagation of S&T and entrepreneurship development strategies.

Dr Radhakrishnan, Professor of Mechanical Engineering, IIT, Madras, highlighted the role played by IITs in promoting technology transfer. According to him, ideas and concepts, as technical knowledge, are commodities in the West and carry good price. But, in India, this fact is totally ignored. The craze for publication at any cost, pushes Indian scientists to give out every technical details which the foreigners find extremely useful for commercial exploitation with marginal inputs. Therefore, Dr Radhakrishnan advised one should file patent applications first and then go in for publications. And one should give only the end results and not the entire procedures in their publications.

'Risk financing and venture capital' was the topic for discussion on 6 June. Dr John V. George, General Manager, Kerala Financial Corporation (KFC), shared KFC's experiences in risk financing, and desired that some incentives be given to financial institutions to take care of the risk in funding unproven technologies. He further observed that there is a credibility gap between the commercialization of equipment fabricated by Indian manufacturers and designed by Indian research scientists. This credibility gap should be overcome.

The session on 7 June was devoted to patents and their importance. Shri G.S. Davar of M/s L.S. Davar & Co., New Delhi, and Shri M.P. Bhatnagar, NRDC, spoke on Paris convention.

Shri N.K. Sharma, Managing Director, NRDC, gave a press conference on the concluding day of the programme in which he said that NRDC had so far licensed 2000 technologies of which 50% were reported to be in production with an annual turnover of Rs 5000 million. NRDC was also promoting export of indigenous technologies to developing as well as developed countries.

Tech Trans-90: Technology Exposition cum Seminar

The Sixth Technology Exposition cum Seminar, Tech Trans-90, organized by NRDC in collaboration with RITES, Madras, STED, Kozhikode, KSIDC, KFC and Regional Research Laboratory (RRL), Trivandrum, was held in Trivandrum on 9 June 1990. The main objective of the seminar according to Shri I.R. Kumar, Deputy General Manager, NRDC, was to provide a platform to the scientists from different national laboratories to present select and proven NRDC technologies to entrepreneurs, and to have a meaningful dialogue between them, in association with experts from financial institutions and consultancy organizations for possible transfer of technologies. Shri N. Viswanatha Menon, Finance Minister, Kerala, inaugurated the seminar; Prof. I.S. Gulati, Vice Chairman, Kerala State Planning Board, presided.

Shri N.Viswanath, General Manager, RITES, in his welcome address narrated the catalytic role played by Industrial Development Division of RITES in promoting commercialization of proven NRDC technologies. Expressing his happiness over the good response from Kerala State to this seminar, he wished RITES to give total techno-economic support to those entrepreneurs who desire to commercialize some of the promising technologies presented in the seminar.

Dr Gulati in his presidential address called for increasing substantially the allocation for industrial investment in the State's Eighth Five Year Plan. Increasing the allocation for industry would undoubtedly require the lowering of the share of other sectors. This is a conscious decision the government will have to take very soon. Kerala's growth of industrial output has been only one third of the national average, the latter itself being very less compared to other countries. Instead of making direct investment, Dr Gulati opined that the government should act more as a catalyst for much larger investment in private and cooperative sectors. For every rupee the government invested, an additional investment of Rs 4-5 should be mobilized.

Chinese Consultancy Contract won by NCL against Global Competition

The National Chemical Laboratory (NCL), Pune, has won a bid for providing consultancy for World Bank-assisted projects in China, against stiff global competition. This is the first such bid won by a national laboratory from India on a global basis and also the first consultancy service ever offered from India to China. NCL's competitors included world renowned companies from USA such as Arthur D. Little Inc., Chem Systems Inc., and International Development Planners. This contract comes to NCL in view of its successful track record in R&D management, technology development and industrial interactions.

In keeping with the government policy to emphasize the export of services, NCL decided to launch itself as an organization offering science and knowledge based consultancy services. NCL management, in a major departure from the past, decided that NCL should not only excel itself in selling processes but also knowledge-based products, which include software and consultancy services.

NCL recently made a bid for consultancy to China against a global enquiry for World Bank-assisted projects. The Jiangsu Provincial Government in China had applied to the World Bank for a loan of $ 100 million to develop the chemical industry including associated R&D institution building. Consultancy services were required to strengthen the research and development capabilities of two chemical R&D institutions, namely the Nantong Synthetic Materials Research Centre (for engineering plastics) and the Suzhou Research Institute of Chemical Industry (for fine chemicals). The Jiangsu Petroleum & Chemical Industry Department in consultation with the World Bank has selected NCL to provide these advisory services.

NCL will identify focussed technological development projects relevant to the needs of the Jiangsu Province, ascertain the programme requirements and implementation strategies and make a comprehensive plan for upgrading the two R&D institutions.

Dr. A. D. Damodaran, Director, RRL-Trivandrum, addressing the 'Tech Trans 90'. Seen on the dais from left are: Shri T. R. Kumar, NRDC; Shri M. Viswanathan, General Manager, RITES, Madras; Shri N. K. Sharma, Managing Director, NRDC; Shri V. Viswanatha Menon, Finance Minister, Government of Kerala; and Dr John V. George, Managing Director, KFC

The Kerala Finance Minister, Shri Menon said the state should opt for high technology industries. Such industries would be able to utilize the educated and skilled manpower resources of the state in a better way. At present, only 10% of the Rs 1500 million currently being invested in industries every year in the State went for high technology industries.

Inviting entrepreneurs to set up industries in Kerala, Shri Menon said that the fiscal incentives for industries introduced recently were as good as those offered by industrialized states. These included 5% investment subsidy, an additional 5% investment subsidy for thrust areas like electronics and 100% sales tax concession for five years. Also, the industrial atmosphere in Kerala was quite peaceful as compared to other states, Shri Menon said.

RRL-Trivandrum: R&D Highlights of 1989-90

The R&D activities of the Regional Research Laboratory (RRL), Trivandrum, are broadly divided into three groups: (1) R&D programmes related to natural products of the region, which include starches and carbohydrates, spices, oil seeds like coconut and oilpalm, cashewnut shell liquid, etc.; (2) Metallurgical and ceramic resources of the region, viz. rare earths, ilmenite and clays; and (3) Projects of strategic and national importance, e.g. advanced materials like special alloys and metal matrix composites, high temperature superconductors, etc.

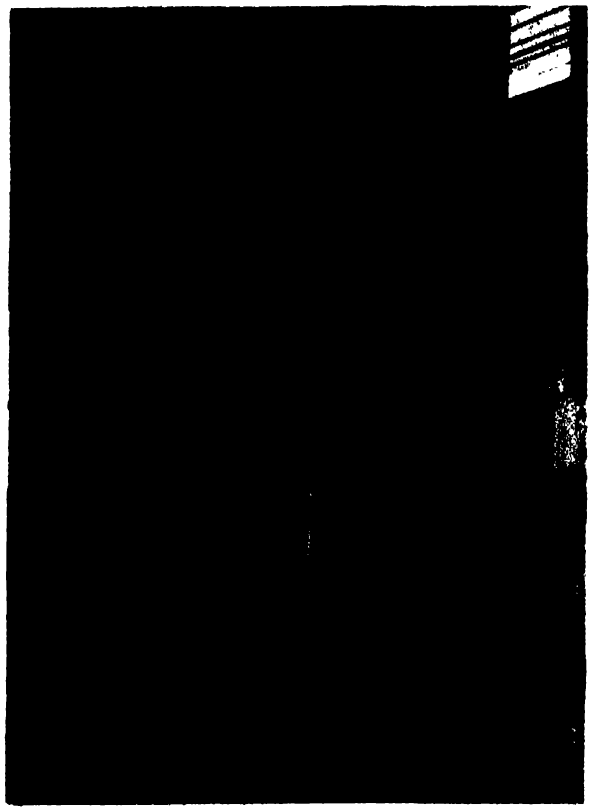
The demonstration plant for extraction of edible grade raw palm oil, set up on turnkey basis at Palode in Trivandrum as a part of the National Collaborative Programme for Oil Seeds between CSIR and ICAR, and inaugurated in January 1989, was operated at optimum efficiency. The quality of oil and operational efficiencies were found to be comparable with international standards. On the basis of this, the laboratory has been asked to prepare a full engineering package for setting up two extraction units of 10 tonnes/day capacity in Andhra Pradesh, with funding under the Technology Mission on Oil Seeds.

Under the aegis of the Island Development Authority, the laboratory undertook a techno-economic survey regarding potential of coconut and oil palm-based industries in Andaman & Nicobar Islands. A feasibility report was submitted to the Island Development Authority suggesting setting up of a plant to process 10 FFB/h of oil palm fruits keeping in view 1600 ha of oil palm plantation.

The work on removal of graphite from clays, sponsored by M/s English India Clays, was completed with the successful commissioning of a commercial level flotation cell. This has enabled the company to utilize poor quality clays from their captive mines for quality paper applications. Arising out of this association, the company, belonging to the Thapar Group, sponsored a project on manufacture of detergent grade Zeolite A. The laboratory scale work was completed and interaction was going on for setting up a commercial plant.

A demonstration plant for making coir polymer (sheet moulded compound) sheets was commissioned at CICT, Bangalore. The trial runs were successful, and the quality of the product was to the satisfaction of the Coir Board, the sponsor.

The laboratory initiated work on behaviour control chemicals for pest eradication. A pheromone for sweet potato weevil was synthesized and field tested in col-



Coir polymer composite set-up

laboration with CTCRI (ICAR). Trivandrum. The success of this venture has attracted the attention of the International Potato Research Centre (FAO), Peru, with which the laboratory is initiating a scheme for field trials in major sweet potato growing centres of the world.

The DST-supported programme on high Tc materials yielded interesting results on oriented grain growth studies. A coil fabricated in the laboratory by cold process gave critical current values approaching 225 amps/cm^2 as measured at the Ceramics Division of Argonne National Laboratory, USA, which is the highest value reported from India.

The computer modelling activity was considerably expanded, particularly with respect to simulation studies in the areas of solidification phenomenon (MMC) and liquid-liquid extraction (RE). A rigorous theoretical model was developed for the evaluation of critical velocity of any metal dispersoid system. Micro gravity experiments for study of particle front interaction and validation of the suggested model were envisaged. A computer simulation model was developed for predicting microstructural evolution in castings. Both these activities are part of the project on metal matrix composites. A proposal for the same was tentatively approved by ISRO (for experiments in the MIR Space Station).

A mathematical model was developed to simulate the liquid-liquid extraction circuit of rare earth separation, which is able to handle multi-component systems of rare earths and would be of great use, since most of the existing models tackle only binary or ternary systems.

The PORIM, Malaysia, would be supporting the laboratory programme on nutritional & biochemical studies on palm oil. The study would be undertaken in collaboration with NIN (ICMR), Hyderabad, who have recommended, after preliminary studies that palm oil can be used as a source of vitamin A for alleviation of deficiency diseases.

The laboratory work on microbial strain improvement for CG Tase production received financial support of over Rs 3 million from DBT, in recognition of the laboratory expertise in this area.

Also, the laboratory received DST funding for its activities in development of speciality polymers from long chain hydrocarbons.

The LPSC Unit of VSSC sponsored to the laboratory a project on development of AS7G castings. This is an indigenization programme since the alloy for the purpose is equivalent to an imported French alloy.

The laboratory filed 12 patent applications during the year.

Interactive Workshop on Postharvest Technology

The Central Food Technological Research Institute (CFTRI), Mysore, organized a five-day workshop, commencing from 11 June 1990 on 'Postharvest technology and its relevance to the development of rural areas, and uplift of women and children'.

Inaugurating the workshop, Shri D.V. Urs, former Vice Chancellor of the University of Mysore, observed that the State Councils for Science & Technology were set up originally to provide an organizational network for diffusion of modern S&T developments for the benefit of common man. He advised the officials of these councils to visit research institutions to get awareness regarding the S&T developments taking place at these centres, and to draw out programmes for implementation in the areas where potential exists for them. He further said that the existing barriers between the Councils and the user population should be removed to make their programmes more effective and visible. Stating that such workshops were a beginning in the above direction, Shri Urs hoped that many more intensive programmes for interaction, training and dissemination would be taken up in future.

Dr D. Rajagopal Rao, Scientist, CFTRI, in his presidential address said that success of transplantation of technology in village depends on the involvement and the active participation of the local populace. Nearly 70% of our population, amounting to nearly 500 million, lives in about half-a-million villages. A host of technologies are readily available at CFTRI that can generate employment as well as income to improve the quality of life of the rural people.

Earlier, welcoming the participants, Dr V.H. Potty, Chairman, Technology Application Division, CFTRI, said that the workshop was a part of the massive programme undertaken by CFTRI to expedite the flow of technologies to the rural sector to generate adequate employment and to tap food resources potential available locally. He expressed the hope that workshops of this nature would be able to sensitize the appropriate rural development and S&T agencies of various states regarding the capacity and capability of CFTRI and thus help percolate the technologies to the rural areas.

The curriculum of the workshop was specially designed for the benefit of science and technology carriers such as representatives of departments of science and technology of all states and state councils of science and technology, rural development agencies and home science departments of various universities. Twenty participants attended the workshop. The workshop aimed at highlighting the technological developments relevant to the needs of the rural and semi-urban areas of the country by competent and experienced S&T managers in the areas of fruits and vegetables, spices, cereals, pulses, edible oils, convenience foods, nutritious products, foodgrain storage and conservation and food laws and regulations. A few processes developed by CFTRI in these areas were also demonstrated.

Shri S.P. Pillai, Area Coordinator, Industrial Development & Consultancy Services of CFTRI proposed a vote of thanks.

Community Response to Components of Urban Transport for Work Journeys through Mode Choice Models

The urban centres in the country are fast expanding in terms of population, space and vehicle ownership, all resulting into in-

creased travel demand. Consequently, urban streets are facing traffic congestion, unsafe travel and environmental pollution. ese problems call for planning of the road system based on comprehensive traffic and transportation studies. Estimation of travel demand is an important facet of transportation planning and modal share estimation is a pivotal stage. This stage has not received much attention in the transportation studies carried out so far and a need for research leading to improvements in the approaches has been emphasized by the planners.

The Central Road Research Institute (CRRI), New Delhi, has a planned programme of research on the 'Modal Split Models' as a part of the activities of its Traffic and Transportation Subdiscipline. Under this programme, Shri S.B. Sripathi Rao of CRRI conducted a research study on urban commuters' response to components of urban transport for work journeys through mode choice models.

The study considers travel as an indirect demand created out of its utility at the ultimate end of the journey, as a commuter wishes to minimize the disutilities incurred during the journey by choosing that mode of transport which involves least disutility. Transport components such as journey time, journey cost and physical efforts are treated as disutilities by commuters. The transport components that discourage the use of public transport are: walking to the boarding point, waiting for the mode at the point, travelling in a crowd and at low speeds. Nevertheless, a travel by an individual mode of transport also has certain deterrant components such as driving through congested roads, exposing to danger of accidents, exhorbitant journey costs towards fuel, tear-wear, etc. The commuter develops weights and trade offs between the components of personalized modes and those of public modes of transport and based on the totality of these weights a mode is decided upon. This process of developing weights and deciding a suitable mode based on this forms the 'mode choice process' in the transportation planning process. The weights attached to each of the components are termed as 'Response to transport components'.

In this study, based on a set criteria to ensure choice for desired mode, the road users were divided into four groups: 'Own mode captive', 'Own mode choice', 'Public transport choice' and 'Public transport captive'. Realizing that a sequential decision making process is involved for choosing the mode of transport by the choice group, Sequential Binary Models were formulated. To test the hypothesis, the travel data of Greater Bombay which has an environment for mode choice were chosen and the formulated models calibrated. These models were established to be logically consistent and statistically valid. The models demonstrate that the transport components play a significant role in choosing the mode of transport.

The study also demonstrated the application of the calibrated models and brought out the implications of policies pertaining to vehicle ownership levels, road network performance, level of service by public transport on modal shares.

Shri S.B. Sripathi Rao was awarded Ph. D. in Civil Engineering by Kakatiya University for his contribution in this area.

Purification and Immobilization of S1 Nuclease

S1 nuclease from *Aspergillus oryzae* is a sugar nonspecific and multifunctional enzyme which acts on single stranded DNA, RNA and mononucleotides. Though competitive inhibition studies have shown that different activities associated with S1 nuclease are catalyzed by the same active site, no conclusive proof exists till now. Secondly, it has been observed that after S1 nuclease treatment of nucleic acid samples, removal of the residual enzyme activity from the reaction mixture is essential and requires repeated extractions with phenol which in turn results in the loss of nucleic acid samples. In such cases, use of immobilized enzymes offers a distinct advantage over the soluble enzyme since these can be removed easily from the reaction mixture by physical methods. Shri L.G. Reddy, a CSIR research fellow, while working at the National Chemical Laboratory (NCL), Pune, carried out investigations with S1 nuclease with a view to: (a) studying the nature of the catalytic site by chemical modification and (b) developing immobilization procedures to obtain highly active and stable immobilized preparations suitable for routine analytical purposes.

Purification and Chemical Modification of S1 Nuclease: Attempts were made to develop a simple and rapid procedure to obtain a homogeneous preparation suitable for chemical modification studies. Takadiastase (α-amylase) powder, after extraction and heat treatment, was subjected to ammonium sulphate precipitation. The fraction containing S1 nuclease was chromatographed on DEAE-cellulose at *p*H 5.0, a procedure in which T1 RNase, T2 RNase and S1 nuclease get separated. High specific activity fractions obtained from this step were pooled and rechromatographed on DEAE-cellulose under the above conditions to obtain the purified enzyme. The enzyme preparation showed a single band both in the native and SDS-PAGE indicating its homogeneity.

When the pure enzyme was treated with different amino acid modifying reagents, only diethylpyrocarbonate (DEPC), N-bromosuccinimide (NBS), *p*-hydroxymercuribenzoate (*p*HMB) and trinitrobenzenesulfonic acid (TNBS) inhibited activities of all the three namely, ssDNase, RNase and phosphomonoesterase, associated with S1 nuclease, indicating the involvement of a single catalytic site. However, substrate protection was observed only against TNBS inactivation, further indicating that the catalytic site and the substrate binding sites are different. Results on chemical modification studies showed that while histidine, tryptophan and cysteine may be involved in the catalytic site, lysine is involved in the substrate binding site.

Immobilization of S1 Nuclease: (a) *Binding through protein moiety*: Crude S1 nuclease was coupled to gelatin-alginate composite matrix using residual free aldehyde groups on the surface of glutaraldehyde crosslinked matrix. The immobilized enzyme retained approximately 10% activity of the soluble enzyme. When the partially purified enzyme was bound to the matrix, the bound enzyme lost all its activity. However, the activity could be restored when the cou-

pling was carried out in presence of a coprotein or substrate. Bound S1 nuclease exhibited superior *p*H and temperature stabilities. Immobilization brought about a two- fold increase in the Michaelis-Menten constant (K_m).

Binding through carbohydrate moiety: Attempts were made to immobilize S1 nuclease through its carbohydrate moiety. When partially purified S1 nuclease was bound through its carbohydrate moiety to Concanavalin A-Sepharose containing increasing amounts of lectin, the retention of activity was high, varying essentially from 75% on 'low lectin' matrix (1 mg of Con A/ml of Sepharose) to no detectable activity on 'high lectin' matrix (8 mg Con A/ml of Sepharose). However, approximately 50% activity could be restored on 'high lectin' matrix when the binding was carried out in presence of glucose, suggesting that the loss of activity on 'high lectin' matrix is due to the conformational changes brought about by the multiple attachment of the enzyme to the matrix. Interaction of Con A with S1 nuclease was used to predict the nature of the carbohydrate moiety and its location with respect to the active site of the enzyme. The researcher found that immobilization resulted in an increase in the optimum temperature *p*H and temperature stabilities, but it did not affect the *p*H optimum. A marginal increase in the apparent K_m was observed. The bound enzyme also exhibited enhanced stability towards 8 M urea. On repeated use, Con A-Sepharose-S1 nuclease conjugate retained more than 80% of its initial activity after six cycles.

Shri Reddy carried out the above work under the guidance of Dr V. Shankar, Biochemical Sciences Division, NCL, Pune, and was awarded Ph.D. degree for his thesis based on these studies.

Children meet CIMAP Scientists

The Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, organized a one-day 'Children Meet Scientists' programme on 30 March, 1990. Sponsored by NCERT, New Delhi, the programme was attended by about 80 students of senior secondary classes. The students were apprised of the research and development activities underway in CIMAP, through a documentary show titled, 'Quest for Perfumes & Drugs' and a visit to the institute's museum, experimental farm and pilot plants. The students took keen interest in various experiments underway in the laboratory.

Students going round the museum at CIMAP, Lucknow

Addressing the students, Dr R.S. Thakur, Director, CIMAP, said that natural products had contributed a lot in medicines, perfumes and flavours. The improved technologies of medicinal and aromatic plants developed by CIMAP had been passed onto the farmers and entrepreneurs, and production of certain items had increased considerably due to the institute's efforts. He commended the NCERT for sponsoring the visit of the students, which gave them opportunity to interact with the scientists and have first hand information about the on-going researches in the institute. In the afternoon, students discussed their thoughts with the scientists of the institute. The questions of the students were answered by the faculty members of the programme, Shri O.P. Virmani, Dr D.V. Singh, Dr J.R. Sharma and Dr K.K. Janardhanan, under the Chairmanship of Dr Thakur.

Students Meet Scientists Programme at CECRI

In the 'Students Meet Scientists Programme' at the Central Electrochemical Research Institute (CECRI), Karaikudi, held on 3 March, about 100 students from different higher secondary schools in and around Karaikudi participated. Prof. K.I. Vasu, former Director, CECRI, inaugurated the programme and Prof. S.K. Rangarajan, Director, CECRI, presided. Dr G. Prabhakara Rao, Deputy Director, CECRI, welcomed the gathering.

The following popular lectures were delivered by CECRI scientists: Electrochemcial science (Dr G. Prabhakara Rao), Science in India (Shri P.V.S. Subramanian), Science for rural areas (Shri K.S.A. Gnanasekaran), Sir C.V. Raman (Dr R. Srinivasan), and S. Ramanujam (Shri R. Srinivasan).

The lectures were followed by a discussion and 'Meet the Scientists' session, in which students freely interacted with the

scientists and obtained information on many scientific subjects.

The students were shown video films on scientific topics, and were taken round the Scanning Electron Microscope Laboratory and library. Shri N. Shanmugam, Convener of this programme at CECRI, thanked NCERT for sponsoring this useful programme.

CEERI's Madras Centre develops Electronic Systems for Pulp and Paper Industry

The Department of Electronics (DoE), Government of India, has been promoting the application of electronics and computers in the process industries for increasing productivity and efficiency, energy conservation, quality control, etc. The Appropriate Automation Promotion Programme (AAPP) is one such programme of DoE to promote the appropriate applications of automation in industries such as steel, cement, fertilizer, pulp and paper, jute and tea.

Under AAPP, a Centre for Development of Electronic Systems (CDES) is functioning at the Central Electronics Engineering Research Institute (CEERI), Madras Centre. This Centre has now developed five appropriate electronic systems for pulp and paper industries, viz. Locomon (Low consistency monitor), Moisture gauge, GSM (grams per square metre) gauge, 'C' frame and 'O' frame instrumentation.

The Locomon measures low pulp consistency, which is an important parameter for uniform quality of paper production. It uses the opto-electronic technique.

The moisture gauge measures the moisture in the paper being produced and helps in energy saving through optimum use of steam. It is based on infrared technique.

GSM gauge displays the basis weight of paper being produced in grams per square metre (GSM) and is based on nucleonic technique.

'C' frame instrumentation enables the measurement of the basis weight and moisture in an on-line mode. This instrument is based on infrared and nucleonic techniques.

'O' frame instrumentation enables the measurement of the following three parameters: basis weight, moisture and caliper. These parameters help in producing quality paper as well as in conservation of energy and raw material. Provision has also been made to automatically control the basis weight and moisture on- line .

The salient features of the above developments are: These systems have been made available in the country for the first time. They have been thoroughly field tested and can be used in all kinds of paper mills, and are particularly ideal for the small paper mills. They can be employed in mills using a variety of raw materials like bagasse, countrywood, straw and waste paper. The technology has been transferred to the following two entrepreneurs to start with: M/s Servall Engineering Industries Pvt. Ltd, Coimbatore and M/s SPA Computers Ltd, Bangalore.

Awareness Workshop on Indigenous Electronic Systems for the Pulp and Paper Industry

CDES will be holding a one-day workshop at SITARA auditorium, Coimbatore, on 26 August 1990, with a view to creating awareness on the functioning of the above electronic systems towards monitoring/control of : Pulp quality, Low consistency, Basis weight, Moisture, Caliper, MD and CD profiles. Results of field trials will also be discussed. Also, a visit to M/s Seshasayee Paper & Boards Ltd, Erode, will be arranged to enable the participants to witness the functioning of these systems in one of their machines.

Further details regarding the workshop can be had from the Convener: Dr P.E. Sankaranarayanan, Project Coordinator CDES (AAPC/DoE) CEERI Madras Centre, Madras 600 113.

PROGRESS REPORTS

NCL Annual Report: 1988-89

The annual report of the National Chemical Laboratory (NCL), Pune, brought out recently, covers the R&D activities of the laboratory under the following heads: Catalysis, Drugs and Drug Intermediates, Biotechnology, Materials Science, Agrochemicals, Time Targetted Projects and Polymers and Process Design.

Catalysis

Most commercial processes via C_1 chemistry are aimed at the utilization of CO and syngas ($CO + H_2$) as feedstocks and in this area, homogeneous catalysis plays a dominant role. During the year, facilities were developed for CO generation and compression, ensuring all safety aspects; high pressure reactors (up to 700 bar pressure) and all the facilities necessary for carrying out high pressure carbonylation, hydroformylation and oxycarbonylation reactions were set up. A high-pressure, high-temperature IR cell for *in situ* analysis of catalytic complexes and investigation of reaction mechanisms was also set up.

Novel homogeneous catalysts were developed for the following processes/reactions: carbonylation of methanol to acetic acid/methyl acetate, carbonylation of ethanol to propionic acid/ethyl propionate, carbonylation of methyl acetate to acetic anhydride, and oxidation of C_4 mixture to methyl ethyl ketone. Basic research was being carried out on: (a) role of ligands, solvents, cocatalysts and promoters on the activity and selectivity of carbonylation, hydroformylation and oxidative carbonylation reactions; (b) reaction mechanism and kinetic modelling of carbonylation reactions; and (c) modelling and simulation of catalytic gasliquid reactions/reactors. A catalytic process was developed for the direct oxidation of *n*-butenes to methyl ethyl ketone with a possibility of simultaneous separation of isobutylene. A pilot plant based on this process was set up and data for scale up were collected.

A platinum-alumina catalyst for reforming of naphtha, developed at NCL within a record time of three years, was tested for more than 3000 h in IPCL's pilot plant. This catalyst was subsequently manufactured by IPCL and loaded in one of their commercial reactors and was functioning very well.

A plant for the production of ethylbenzene (20,000 tonnes/annum) using NCL's

technology was set up at the Hindustan Polymers Limited, Vaizag. The Encilite-2 used in the above plant (2.5 tonnes)was manufactured by United Catalysts (I) Limited, Vadodara. This one-step process starting from ethanol has 95% selectivity for ethylbenzene.

A novel process for the production of propionic acid via carbonylation of ethanol using a low pressure/low cost catalyst was developed. GAAC, Ahmedabad, is planning to install commercial plant of 3000-4000 tonnes/annum capacity based on the process.

The laboratory scale development and design of a pilot plant for production of acetic acid via carbonylation of methanol (capacity 2 tonnes/day) was completed. This pilot plant is expected to be commissioned in 1990/91. The process involves the use of a novel low cost/low pressure catalyst, and will be the first one to be commercialized in the world. It has great export potential.

Also, a catalytic process was developed for the synthesis of carbamates, not involving phosgene and methyl isocyanate (MIC). A pilot plant is proposed to be set up at Excel Industries, during 1990. This is the first time a non phosgene, non MIC route is proposed for carbamates. This approach would also be useful in developing processes for other carbamate derivatives and isocyanates.

A project on Analysis and Design of Multiphase Catalytic Reactors, with specific interest in high pressure chemical reaction engineering, was undertaken in collaboration with the University of Erlangen, West Germany.

Drugs and Drug Intermediates

Duryne is a cytotoxic polyacetylene derivative isolated from marine sponge *Cribrochal inadura*. Duryne possessing the central E and Z double bond was synthesized for the first time using dialkylated acetylene.

Isolated from marine sponge *Halichondria panic*, panicein A shows biological activity against several microorganisms. An E/Z mixture of this aromatic sesquiterpenic quinone was synthesized for the first time by Wittig olefination.

A seven-step laboratory process for the preparation of carbamazepine, an analgesic and anti-convulsant drug, was developed starting from *o*-nitrotoluene. The process was demonstrated to Resonance Laboratories Pvt. Ltd, Bangalore.

β-Lactam antibiotics (penicillins and cephalosporins) are among the most important life-saving drugs in use today. No indigenous technology is, however available for 7-ADCA, the key intermediate. The laboratory developed a process for the conversion of penicillin G to 7-ADCA involving three steps.

Biotechnology

The process for the production of ethanol from molasses using an immobilized catalyst (*Encillium*) was scaled up in a 300 L bioreactor. Further trials were being continued with the participation of selected distilleries.

NCL is pursuing a long term project on genetic manipulation of seed storage proteins in rice and pigeon pea with a view to gaining information on storage proteins and genes encoding them. The development of sensitive and rapid RIA and ELISA for quantification of storage proteins, and construction of genomic library and identification of specific clones were carried out. Work was continuing on: (a) isolating the cDNA clones for glutelin and prolamin storage proteins in rice and vicilin storage protein in pigeon pea, (b) sequencing the genomic clones, and (c) standardizing gene expression assays.

Materials Science

The laboratory's work in the field of Materials Science was related to: Solar/semiconductor grade polycrystalline silicon, High performance ceramics, Amorphous silicon alloys for photovoltaic applications, High temperature superconductivity and Structural Chemistry.

Agrochemicals

Several enriched plant extractives or their combinations were being investigated for use in mosquito, termite and cyclops control, with a view to developing a succession of the combinations to provide biorational supplements for pest vector management programme. The design of controlled delivery systems was a major endeavour. A gel dispense system was earlier developed for aquatic larvicides. These 'satellites' hydrogel dispensors were also being adapted for cyclops control. This project was funded by the National Water Mission. Control of cyclops, the guineaworm vector, was achieved using an easily available, inexpensive, natural product.

The laboratory-scale methods were developed for the preparation of 1-methylamino-1-methylthio-2-nitroethene —the crucial nitroenamine intermediate for ranitidine. The first method follows the conventional route from 1,1-bismethylthio-2-nitroethene and leads to a 60-68% yield of the required product, based on recovered starting material. The second method is based on a radically new approach and makes use of the catalyzed condensation of nitromethane with N-methyl carbonimidodithioic acid ester.

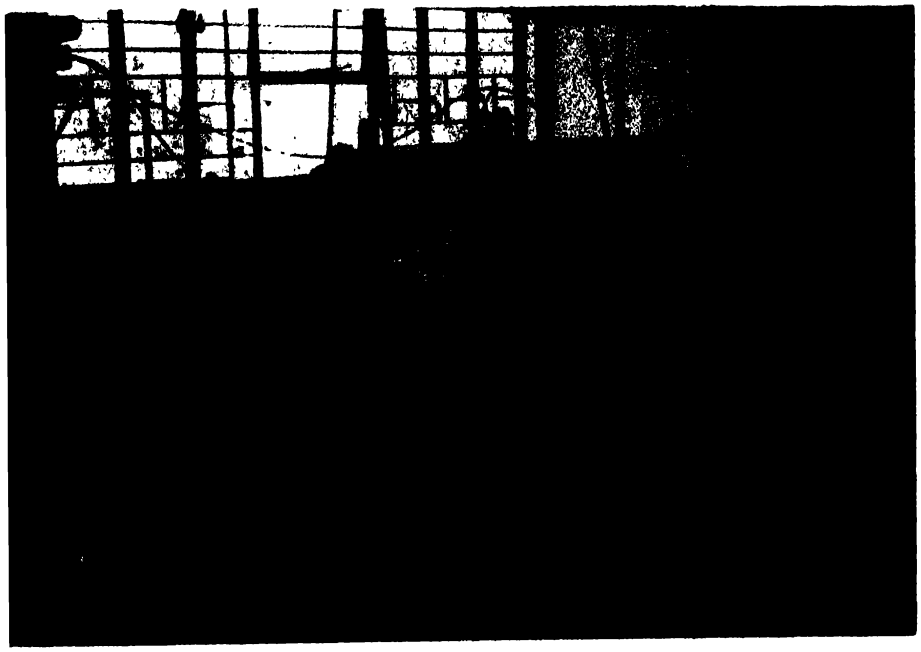
A collaborative project between NCL and Godrej Soaps Pvt. Ltd, Bombay, for the synthesis of homobrassinolide, a plant growth promoter, was completed. Starting from stigmasterol, 30g of homobrassinolide were prepared in eight steps and supplied to Godrej. The product was found to be active in ppm concentration under controlled laboratory conditions. The company started elaborate field trials on a variety of agricultural crops.

A simple process was developed from neem seeds for Neemrich-I and Neemrich-II exhibiting different insect control activities. The process was scaled up to 20 kg (seed level) and a stable formulation was prepared from the product.

Field trials were conducted on tobacco crop at the Central Tobacco Research Station, Rajahmundry, and on cotton crop at Nimbkar Agricultural Research Institute, Phaltan, with encouraging results.

Time Targetted Projects

p-Diethylbenzene is used as a solvent in the manufacture of *p*-xylene. The demand for *p*-diethylbenzene has grown considerably and is being met by imports at present. Owing to the setting up of large production capacities in India for terephthalic acid and dimethylterephthalate, for which *p*-xylene is a raw material. A zeolite



Drag reducers for oil transport

based catalyst with more than 95% selectivity for *p*- diethylbenzene was developed. Pilot plant trials using this catalyst were underway.

2,6-Diethylaniline (2,6 DEA) is an important intermediate in the manufacture of herbicides like butachlor. The entire requirement of this chemical is met by imports. A process was standardized using ethylene and aniline as raw materials, and was demonstrated on bench scale. A plant for the manufacture of 600 tonnes/annum of 2,6 DEA was designed. This technology developed for Navin Chemical Enterprises, Bombay, was expected to be commercialized soon.

Polymers

With a view to developing drag reducing polymers for the transportation of crude oil and its products through pipe lines, the laboratory developed a polymer which showed better performance than that of a commercially produced polymer. It was also found to be better in terms of shear stability. The synthesis of the polymer was demonstrated to the sponsoring company, Lubrizol India Ltd, who would be taking up pilot scale production of the polymer. The software developed was handed over to the Institute of Petroleum Technology, Bombay, Efforts were underway to make the application of the software more extensive.

A new fibre reinforced thermoplastic (FRTP) composite material was successfully developed for the rotor fan of Bajaj scooters.

Process Design

A new methodology was developed for designing a heat pump that could be advantageously integrated with a heat exchanger network. A user friendly software package was being prepared.

A novel approach was developed for evaluating the sensitivity of a given heat exchanger network. This approach, based on the partial linearity inherent in heat exchanger networks, reduces the computation time by an order of magnitude.

A simple mathematical model for the continuous drum granulator for a diammonium phosphate (DAP) plant was developed incorporating all possible physico-chemical processes like slurry coa ting of recycle fixes, agglomeration and particle growth, ammonia fixation, and moisture desorption under conditions encountered in a commercial granulator. This model was being readied for comparison with plant data.

Mathematical models were also developed for the simulation of absorbers for treatment of acid gas.

CFB Annual Report : 1988-89

The objectives of the Centre for Biochemicals (CFB), Delhi, include: (i) To produce and supply products of strategic importa nce in biological research as a service, until these are taken up for routine production by commercial undertaking(s),(ii) To take steps for the establishment of a commercial undertaking which will ensure a regular, off-the-shelf supply of research chemicals and biochemicals, especially those required for advanced biological research, and to feed such a commercial undertaking by developing methodologies for preparing newer products, and (iii) To conduct research on indigenously available natural products (ve noms, gums, seeds, etc.) for isolating research chemicals and bringing out their commercial potential. The significant R&D activities of the Centre during 1988-89, as given in its annual report for the period, are summarized here:

Pollen grains from different grasses have been shown to be highly allergenic, containing more than one allergen. In India, no study has been reported regarding the differential allergenic components found in grass pollen grains. With a view to studying the allergens present in grass pollens, five pollens, viz. *Cenchrus,Pennisetum, Zea mays, Imperata* and *Sorghum* were collected from open spaces in Delhi. The purity of pollens was checked, they were defatted and extracted. The extracts were lyophilized for further processing.

Studies were conducted to assess the potential of liposomes in immunomodulation on challenge with allergens in mice. The initial experiments proved for the first time that the entrapment of allergens in liposomes suppressed the IgE response insensitized animals and at the same time increased the IgG response.

A new project on the aerobiological survey of fungal airspora of Delhi was taken up under the sponsorship of the Ministry of Environment and Forests. Under the project, various species of *Aspergillus, Cladosporium, Epicoccum, Alternaria, Rhizopus, Penicillium* and some other fungi were rerorded in library environ ment. A survey through a questionnaire revealed that about 50% of the library users suffer from respiratory problems. Such

studies were being also taken up at a poultry farm, a bakery and a hospital.

Aspergillosis comprises a number of clinical forms such as ABPA, lispergilloma, invasive aspergillosis, chronic necrotising aspergillosis. Early diagnosis is an important factor and requires well defined and characterized antigen for immunodiagnosis. Diagnostically relevant antigens of *A. fumigatus* were identified. Antigens with molecular weights 70,34 and 28 kd with isoelectric points 5-7 are bound to Con A and both IgG and IgE inducing in nature. A number of antigens in the molecular weight range of 14-70 kd were observed to be useful for immunodiagnosis based on the detection of specific IgG antibodies. A dot immuno binding assay was standardized for detection of specific IgG and IgE antibodies. This assay is helpful in simultaneous analysis of a number of fractions during purification, etc. and requires micro quantities.

Under a DBT-sponsored project, the centre standardized methodologies for the preparation of different restriction enzymes and other fine chemicals such as vector DNAs, DNA molecular size markers, dephosphorylated vectors, etc. During the year, two new vector DNAs, viz, pUC9 and pUC18 were offered for sale. A third vector pUC 19 would be available soon. Alongwith this, the preparation of dephosphorylated vectors of pBR322 was standardized. Simultaneously, the supply of earlier products was being main tained. The new method developed at this Centre for the large scale preparation of λ-DNA has hepled in production of large batches of λ-DNA.

A new matrix, LIPSEP GEL, was developed for isolation and purification of brain gangliosides. This method is inexpensive and results in one step purification of gangliosides as against existing methodolgies for the purification of gangliosides. The gangliosides obtained by the above method have a high content of sialic acid and less impurities such as peptides and phosphorus. A patent application for this method of purification of brain gangliosides has been filed.

A method for the production of bovine serum albumin (BSA) was developed and adopted for routine production. This method is economical and less time consuming and gives a very good quality product. It gives a single band on polyacrylamide gel electophoresis (PAGE). Also, a method was developed for the production of ophthalmic grade hyaluronic acid, from rooster combs. The product is in the form of white material which slowly dissolves in water or physiological buffer to give a very viscous solution. The protein content of the product is in the range of O.2% and the OD of 1% solution at 257 is less than 1.0 which points to a low nucleic acid content. The tests carried out on rabbit eyes to confirm the feasibility of this product for ophthalmic use gave satisfactory results. A patent has been filed for hyaluronic acid.

CFB continued to make regular collection of various raw materials such as pollen, fungal types, dusts, insects, animal danders, foods, etc., as per the requirement for antigen production. About 190 diagnostic kits containing various antigens ID tests were prepared and supplied to different allergy diagnosis centres in the country. More than 9000 prescriptions were prepared for individual patients as per the orders received from allergy practitioners. The antigenic extracts were prepared in bulk from several pollen types with a modified method to make available the prick test antigen as well as well ID test antigens.

Also, several batches of various biochemicals were produced and made available to the scientists working in different disciplines. These compounds include: albumin (bovine), albumin (egg), ammonium sulphate (enz. gr), catalase, cellulose carboxymethyl, cellulose EC-TEOLA, cellulose phosphorylated cellulose for column chromatography, cellulose for TLC, cellulose nutritional, cholesterol crystalline, cytochrome C, O-dianisidine HCl, F.C. Reagent glycogen glycyl glycine HCl, hemin, hyaluronic acid, hyaluronidase, lysozyme, *p*-nitrophenyl phosphate, phytohemmaglutanin, peroxidase, starch (rice), etc. The total selling cost of these products works out to be Rs 3.26 lakh.

Several organic chemicals were prepared for meeting the requirements of scientists working in the field of biological and clinical studies. These chemicals included chromogenic substrates, histochemicals, and other chemicals used in diagnostic kits. Also, some 250 products/samples received from outside were analyzed on payment basis.

Indian Journal of Technology's Special Issue on Materials Science and Engineering

The Indian Journal of Technology, a monthly journal of the Publications & Information Directorate, New Delhi, devoted to publishing original research papers in all branches of engineering and technology has brought out a special issue (Vol. 28, June-August 1990) on Materials Science and Engineering.

The issue was initiated taking cue from a study conducted by the US National Science Foundation on the strengths and weaknesses of Indian science, which identified materials science research as an area of great strength. It has been brought out at a time when there is an upsurge in the worldwide awareness of the key role that materials play in the modern day technological world.

The selection of papers represents a comprehensive but not exhaustive overview of the current Indian research focus. The issue carries 26 articles classified under : Selection of materials in mechanical design; Metals and alloy development; Ceramic and glossy materials; Polymers and composites; Structural analysis of materials; and Processing of materials using different techniques.

This issue is guest edited by three of the India's outstanding metallurgists/materials scientists, namely Prof. P. Rama Rao, Prof. S. Ranganathan and Prof. Subrata Ray.

Copies of the issue (pp 217-524; price: Rs 160.00, £ 35.00, $ 54.00) can be had from the Sales & Distribution Officer, Publications & Information Directorate, Hillside Road, New Delhi 110012.

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High speed LCA air intake model (1/4 scale) designed and fabricated for ADA by NAL, Bangalore (p. 181)

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Physiological and Biochemical Studies on Medicinal and Aromatic Plants in CIMAP

A.H. ABAD FAROOQI

Division of Plant Physiology & Biochemistry, Central Institute of Medicinal and Aromatic Plants, Lucknow

The utilization of medicinal plants in curing human ailments is as old as civilization. Plants form a source of many important drugs, essential oils and aromatic principles since the ancient times. Essential oils obtained from aromatic plants are widely used in perfumery, cosmetics, food products and pharmaceutical preparations. In an effort to exploit medicinal and aromatic (M&A) plants, systematic investigations have been undertaken at the Central Institute of Medicinal & Aromatic Plants (CIMAP), Lucknow, for the improvement of cultivation practices and development of new varieties of plants of medicinal and aromatic importance. Summarized here are the efforts made at CIMAP during the last ten years to investigate the physiological problems and to improve the understanding of physiology and biochemistry of important M&A plants.

AROMATIC PLANTS

1. Aromatic grasses

Factors controlling essential oil biosynthesis in aromatic grasses

(i) *Lemongrass:* It has been reported that essential oil and citral content of lemongrass varies a great deal and it depends on a variety of factors, e.g. age of the plant. In this study the effect of age on essential oil content was analyzed in lemongrass. Significant differences were observed in the quantity and quality of the oil in the leaves of different ages. The essential oil and citral content were much more in the young leaves as compared to mature leaves. Active period of biosynthesis was up to 20 days age.

The study of enzymes indicated that acid invertase and β-amylase are the major enzymes involved in sucrose and starch break-down, respectively The activities of these enzymes were found to be greater in the younger leaves as compared to mature leaves.

Geraniol dehydrogenase which catalyzes the oxidation of geraniol to citral was isolated and purified from lemongrass leaves. Catalytic and regulatory properties of the enzyme were studied. Also studied was the effect of various inhibitors, SH-group binding agents, chelators and divalent cations on the enzyme activity. Geraniol dehydrogenase was found to differ from alcoholic dehydrogenase in many respects and it was separated from the latter by polyacrylamide gel electrophoresis. Use of geraniol dehydrogenase is recommended for screening of different cultivars.

(ii) *Citronella java*: As in lemongrass, in citronella java also only partially expanded leaves can synthesize and accumulate essential oil substantially. Citronellol dehydrogenase, the enzyme involved in the formation of citronellal from citronellol, was isolated from the immature leaves.

Effect of micronutrients on oil content and plant growth in aromatic grasses

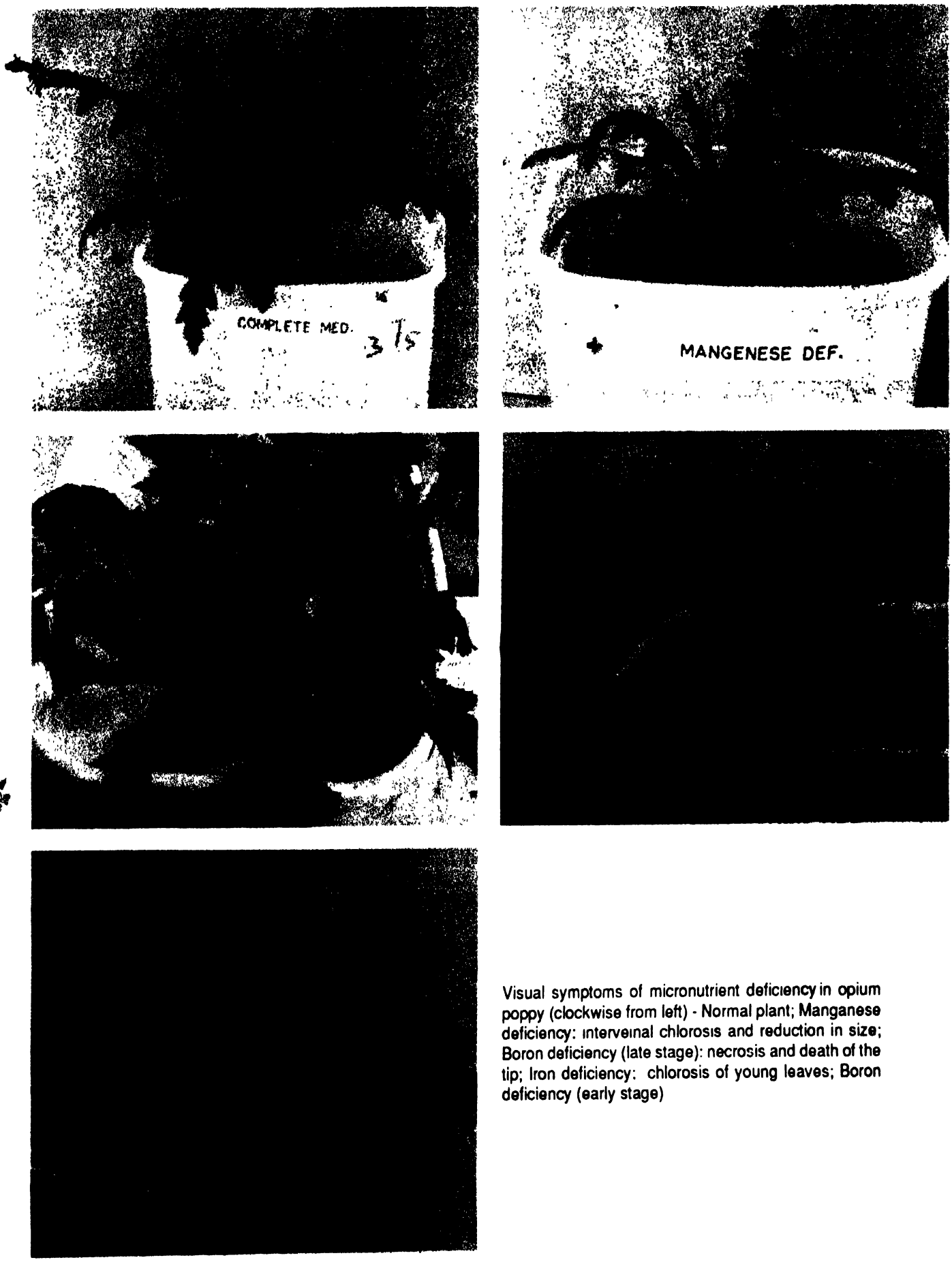
In aromatic grasses biosynthesis of essential oil is influenced by nutritional and environmental factors. Here, effects of micronutrients and water stress on essential oil formation in lemongrass and citronella java were studied in detail.

(i) *Cymbopogon flexuosus* (Steud) Watts: Plants raised in nutrient deficient' medium developed visible symptoms of manganese, copper, iron and zinc deficiency. A significant decrease in oil content of the plants was also observed. Similarly, citral percentage in the oil was found to be influenced mainly by zinc, iron and boron deficiencies. Positive correlation was observed between iron supply and oil content from 0.056 to 5.6 ppm iron.

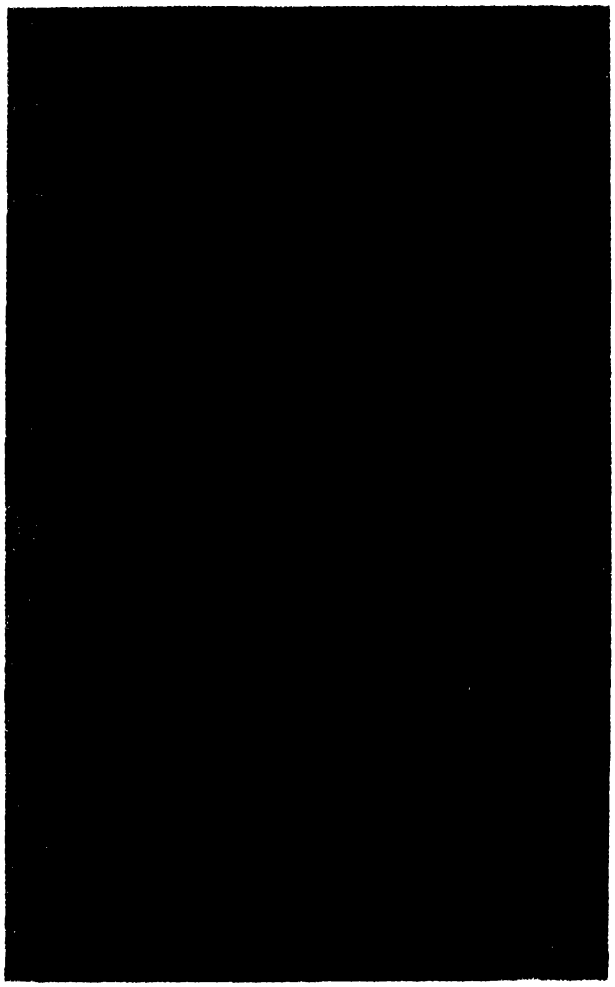
(ii) *Cymbopogon winterianus* Jowitt: In citronella java copper and iron deficiencies were found to cause significant decrease in oil content. The effects of deficiencies of other micronutrients like zinc, manganese and boron were not so marked and varied at the different stages at which plants were harvested. Micronutrient deficiencies decreased the citronellal content. The effects of copper, zinc and iron were relatively more pronounced. Plants subjected to deficiencies of copper, zinc, manganese, boron and iron in sand culture developed visible symptoms of the deficiencies.

Physiological basis of drought tolerance in lemongrass

Water stress was induced in lemongrass plants by growing plants without irrigation. Control plants were kept well watered. Oil content increased significantly due to moisture stress treatment while herb yield decreased only marginally. Accumulation of abscisic acid and water potential in the leaves were high in the stressed plants.



Visual symptoms of micronutrient deficiency in opium poppy (clockwise from left) - Normal plant; Manganese deficiency: interveinal chlorosis and reduction in size; Boron deficiency (late stage): necrosis and death of the tip; Iron deficiency: chlorosis of young leaves; Boron deficiency (early stage)



Visual symptoms of micronutrient deficiencies in lemongrass (clockwise from top left) — Zinc deficiency: stunted growth and chlorosis in young leaves; Iron deficiency: chlorosis of the young leaves; and Copper deficiency: young leaves failed to unroll, bushy habit and bleaching of leaf lamina

2. *Mentha arvensis* (Japanese mint)

Effect of growth retardants on essential oil content and growth

Japanese mint is one of the most important sources of menthol. Much of the previous research on effect of plant growth regulators on mints has been done with other species. This study was undertaken to examine the effect of growth retardants on essential oil synthesis in Japanese mint.

In field experiments with Japanese mint, using different growth retardants, chlormequat chloride (CCC) increased the oil content significantly and inhibited growth to a small extent only. The oil content was negatively correlated with herb yield and plant height but it was positively related with leaf/stem ratio.

Effect of micronutrients on oil content and plant growth in Mentha arvensis

Plant and leaf age, temperature and other climatic and soil conditions influence oil content and its composition in Japanese mint. Although, there were reports pertaining to effect of major nutrients like nitrogen, phosphorus and potassium on growth and oil content of *Mentha arvensis*, effect of micronutrients had not been studied in this context. Effect of micronutrients like copper, iron, boron, zinc and manganese was investigated on plant growth and oil content in sand and water culture. Boron deficiency was found to decrease the growth and copper, manganese and iron deficiencies decreased the oil content. Plants to which boron was not provided, developed visual symptoms of boron deficiency. Boron supply between 0.5 to 1.0 mg/l was optimal for best oil yield. Fresh and dry weight increased to maximum at 0.05 mg/ml manganese level.

Growth parameters increased with up to 5.6 ppm iron, whereas amount of chlorophyll and photosynthetic rate were maximum at 11.2 ppm iron. Maximum oil (0.63%) and menthol (98.7%) were recorded at 0.05 ppm of zinc supply. Photosynthetic rate and chlorophyll content increased with up to 0.5 ppm zinc supply.

3. *Rosa damascena*

Effect of plant growth regulators on flowering

Rose is an important essential oil yielding crop. However, the total flowering period in a year is only 30-40 days in India and flower yield is low. Attempts were therefore made to improve its flower bearing ability by treatment with plant growth regulators. Spraying of ethrel at 0.06% increased significantly the number of flowers and flower bunches per plant but a decrease in the oil content and weight of petals was observed at the same time. However, kinetin (10 ppm) application increased the flower yield per plant as well as flower petal weight. Thus kinetin (10 ppm) is better than ethrel (0.06%) for improving flower and oil yield of *Rosa damascena*

In non-flowering plants, the amount of endogenous gibberelin-like compounds was high as compared to flowering plants. Moreover, a flavonoid growth inhibitor was obtained from non-flowering plants while there was no evidence for presence of such growth inhibitor in the flowering plants.

MEDICINAL PLANTS

1. Physiological studies on rhizome dormancy in Costus speciosus (Koen) Sm. and Dioscorea floribunda Mart & Gal.

C. speciosus and *D. floribunda* are natural sources of diosgenin. *D. floribunda* is cultivated in tropical and subtropical regions of the world while *C. speciosus* is indigenous and grows wild at various places. The growth cycle of *C. speciosus* is characterized by a period of dormancy of the mature rhizome. In field experiments, synthetic auxins like NAA and IBA were found to be effective in increasing sprouting efficiency of rhizome. There was considerable increase in sprouting due to leaching of growth inhibitors. High abscisic acid (IAA) level was found in mature and dormant rhizome. Changes in ABA and phenolic acids occurred during dormancy and sprouting.

D. floribunda undergoes dormancy during winter due to short day conditions and low temperature. In the tubers of *D. floribunda*, abscisic acid content was high in all the parts during the dormant conditions in the winter, but it decreased to a very low level in the actively growing plants. ABA content of the entire tuber was negatively correlated with temperature and photoperiod. Growth inhibitors including batatsin-I phthalic acid were identified in the dormant tuber.

2. Physiological studies in Artemisia annua

A.annua is a Chinese medicinal herb. Aerial parts of this plant are source of antimalarial drug artemisinin. Very little is known about variations in the hormones during development of *A. annua* and the influence of growth regulators on growth and artemisinin content. *A.annua* plants contain maximum artemisinin content during the flowering stage at the age of sixteen weeks. Thus flowering stage of the plants is the optimum harvesting stage. Application of TRIA up to 1.5 ppm was found to produce positive effects on plant height and herb yield. Artemisinin content and yield also increased in the TRIA-treated plants at 1.0 and 1.5 ppm concentrations. Application of chloromequat at 1000 ppm increased the herb yield. Artemisinin content and yield were significantly augmented by the application of 1000 and 1500 ppm of chloromequat.

Three cytokinins zeatin, dihydrozeatin riboside and a novel cytokinin 6-(3'- methyl-butylamino)-2-hydroxy-7,8-dihydropurine were isolated and characterized from leaves and stems of *A.annua*.

3.Effect of nutrients on growth and alkaloid content in Papaver somniferum L.

One of the important factors is nutrient supply which influences growth of the poppy plants. Among the micronutrients, opium poppy was found to be highly sensitive to boron deficiency. Visual deficiency symptoms like blackening and death of growing tips were observed up to 0.05 ppm boron supply accompanied by significant depression in growth and opium content. Plants sprayed with 0.5% boric acid within 0-2 days of appearance of symptoms recovered significantly.

4. Effect of triacontanol on photosynthesis, alkaloid content and growth in opium (Papaver somniferum L.)

The influence of growth regulators on growth and alkaloid content of poppy plant had been studied to a limited extent. Investigations were made on the influence of different foliar applications of triacontanol (a growth promoter) on growth, CO_2 exchange, capsule development and alkaloid accumulation. Plant height, capsule number and weight, morphine content and CO_2 exchange rate were found to be maximum at 0.01 mg/l TRIA. Thebaine and codeine contents remained unaffected.

NRDC INDEPENDENCE DAY (1990) AWARDS FOR MERITORIOUS INVENTIONS

The National Research Development Corporation (NRDC) has announced the 1990 Independence Day Awards for innovative inventions under its Invention Promotion Programme. Of the four inventions chosen for the awards, two are CSIR inventions. Also the Prize Award Committee has announced gold and silver medals for 1990, sponsored by the World Intellectual Property Organisation (WIPO), a specialized agency of the United Nations. A CSIR process has been chosen for the gold medal.

Process for the Manufacture of Monochrome Television Picture Tube Phosphor

Dr P.K.Ghosh, Shri H.P. Narang, Shri Harish Chander and Dr Virendra Shanker of the National Physical Laboratory, New Delhi have been chosen for a joint award of Rs 50,000 for developing an innovative process for the manufacture of monochrome television picture tube phosphor using commercial grade raw materials available indigenously. The process envisages the preparation of high purity zinc sulphide and cadmium sulphide and activating them with controlled amounts of impurities. The phosphor produced has been tested and approved by two leading TV picture tube manufacturers and has been licensed by NRDC to industry.

Hybrid Thick Film Microcircuits

Dr W.S. Khokle, Dr S.K. Bhatnagar, Shri Y.K. Jain, Dr H.C. Pandey, Dr P.K. Khanna, Shri Dwarka Prasad, Shri R.N. Singh, and Shri N.L. Sharma of the Central Electronics Engineering Research Institute, Pilani, and Shri Vedu Mitter of M/s Mini Circuits Ltd, Bangalore, have been chosen for a joint award of Rs 50,000 for the development of a knowhow for fabrication of thick film hybrid microcircuits by the screen printing of conductive, dielectric and resistive pastes on alumina substrates. Over 2000 hybrid microcircuits of 80 different types have been produced for various applications, some of them qualifying for Defence and Space requirements.

An Improved (Modular) Cell for Production of Magnesium Metal by Fused Chloride Electrolysis

Shri P.S. Desikan, Shri K.S. Srinivasan, Shri A. Selvakesavan, Shri G.N. Kannan, Shri S.M. Sukumaran, Shri L.K. Srinivasan, Shri P. Subramanian, Shri C.O. Augusthi, Shri T. Sohan Devasahayam, Shri N. Rajagopalan, Shri K.S. Dandapani and Shri S. Srikantan of the Central Electrochemical Research Institute, Karaikudi, have been jointly chosen for the WIPO Gold Medal for the development of an improved (modular) cell for production of magnesium metal by fused chloride electrolysis from sea-bitterns and magnesite.

5. Change in fatty acid composition accompanying the deposition of triacylglycerols in developing seeds of opium poppy

Opium poppy seeds have a high lipid content and are used as food. Fatty acid composition in relation to seed development was investigated. The nonpolar lipids, particularly triacylglycerols, constituted a major portion (86%) of the total lipids. The active period of their synthesis lies between 15 and 20 days after flowering. The relative percentages of polar lipids, sterols and free fatty acids in the oil declined with seed maturation. Palmitic, oleic and linoleic were the major fatty acids at all the stages of seed development, but there was a clear predominance of linoleic acid.

CYTOKININS FROM MARINE ORGANISMS

Cytokinins which are known to be involved in cell division and differentiation in plants have also been found in microorganisms and in algae and seaweeds. The commercially available sea weed extracts which are used to improve the yield in agriculture possess high cytokinin activity. CIMAP has examined the cytokinin activity in several green algae and blue coral collected from Indian coastal areas. Zeatin and isopentenyladenine were obtained from *Valoniopsis pachynema* (code NIO-212) and *Caulerpa textifolia* (NIO-215), respectively. Further, isopentenyladenine and zeatin riboside were present in *Udotea indica* (NIO-213). Dihydrozeatin and a novel cytokinin2-hydroxy-6-methylaminopurine, have been isolated from the blue coral (NIO-156) and another new cytokinin 2-hydroxy-1'-methylzeatin has been obtained from a green alga (NIO-143).

CONCLUDING REMARKS

From the above studies it can be concluded that growth of and active principle yield in M&A plants

can be improved significantly by the use of bioregulators. Similarly, nutritional and photosynthetic studies can help in the development of new cultivars. Study of enzymes are required for complete understanding of the various biosynthetic pathways of M&A plants. Further research activities are required on physiological and biochemical aspects of M&A plants for proper understanding of the various internal and external factors affecting growth and biosynthesis of active principles. These investigations will also help improve M&A plants with the techniques like genetic engineering and tissue culture.

Besides the author, the other scientists involved in physiological and biochemical investigations are: Dr R. Luthra, Dr N.K. Srivastava, Dr Ajay Misra and Dr R.S. Sangwan.

LCA Air Intake Model handed over to Aeronautical Development Agency

The National Aeronautical Laboratory (NAL), Bangalore, handed over a 1:4.405 scale LCA air intake model to the Aeronautical Development Agency (ADA), on 30 March 1990. This model is of complex geometry and makes extensive use of composite structure (using carbon fibre epoxy) with high strength steel as core material to keep the model fabrication effort and the weight low.

The proposal for designing and fabricating the model was made by ADA in February 1989, and the assignment was to be completed within 10 months, so that the LCA intake configuration could be frozen. NAL accepted this responsibility for the design and fabrication of the air intake model, although prior experience in fabricating such a complex composite model, requiring intricate instrumentation, did not exist. There was, however, enough expertise available at NAL in building composite hardware using glass fibre and steel. The project was conceived as an interdivisional activity within NAL (with some support from private industries) with a two-tier project management structure. Some special provisions were made for accelerating procurement of various items required for this work. A Review Board was constituted, involving outside experts in the field and others from ADA, Design Bureau of HAL and NAL, to review the progress of the project periodically

The work started around mid May 1989 in full swing with strong interaction between ADA and NAL scientists. The model design was cleared by the Review Board after a critical review during October 1989. The model was conceived to be modular in nature so that different variants could be tested with minimum modification on the model. The masters for the various components of the air intake model were fabricated using numerically controlled machines so that a high degree of accuracy could be achieved. The material used for the master model was seasoned and laminated teak wood was used as core material. This choice of material reduced the machining time considerably and made the handling easy.

The model design was checked through the FEM analysis using the NASTRAN software to ascertain accurately the stress levels and the factor of safety values available for all the critical points so that the ONERA (France) requirements of model safety were complied in all respects. The model fabrication process also was to be cleared by the ONERA authorities, so that the standard of materials, process used for fabrication, special welding required for metal component, etc. were all approved by competent authorities. All the components were subjected to rigorous inspection for ascertaining the required accuracy. The fabrication of the various moulds for the main model and the components were completed by March 1990 and subsequently statically tested on a specially designed static test rig. It was found that the model was able to withstand the ultimate load of 3300 kg for which the model had been designed, without undue deflection and the stresses were well within allowable limits; this was a very strong requirement from ONERA for testing this model in their wind tunnel facility. Exchanger mass flow and also the yaw control mechanism were all brought to normal functioning state and a separate controller was designed for their remote operation

The model, with all its components, was assembled and checked for its correct operation before it was formally handed over to ADA. The model has been successfully tested in the ONERA high speed facility during May 1990 and found totally satisfactory. It is learnt that ADA has saved nearly Rs 20 million in foreign exchange as a result of the laboratory's effort in making this sophisticated air intake wind tunnel model. As a result of this exercise, the laboratory now has the know-how and the technology for the design and fabrication of sophisticated flow through wind tunnel models involving the use of composite materials and structures technology

First Printing Ink Unit in NER starts Trial Run

The Luit Udyog, Guwahati, has set up an unit for manufacturing both letterpress and offset printing inks

with the technical advice and assistance from the Regional Research Laboratory (RRL), Jorhat. This is the only unit in the north eastern region (NER) manufacturing printing inks.

Printing ink manufacturing is a major industry in our country and it holds an important place within the chemical industry. The present ink market in the country is of nearly 1000 million of rupees, out of which organized sector enjoys a share of 50% and the rest goes to the unorganized units. The share of unorganized units is rising steadily due to their competitive price, ink manufacture as per customer's requirements and prompt delivery. With the growth and modernization of printing industry, the demand for different types of printing inks is increasing day by day.

In the north eastern region of the country, there are hundreds of printing presses to meet the growing demand for printing work, but not a single unit to produce printing ink. The Luit Udyog is the first firm to set up a unit for producing different types of printing inks, and the firm has been provided formulations and other necessary technical assistance in the form of advisory consultancy by RRL. The laboratory has assisted the firm in the selection of plant and machinery, installation of the machinery, and also provided specifications of chemicals, products and testing equipment. It has also assisted the firm in the commercial production. The different grades of inks produced by the firm have been accepted by some big printing houses of Guwahati. The firm intends to market the inks throughout the states of the north eastern region.

Water Hyacinth Paper Plant in Manipur

The Regional Research Laboratory (RRL), Jorhat, took up the process development work for manufacture of paper from water hyacinth under the sponsorship of Commonwealth Science Council, London. The project was supported by a substantial grant from the United Nations Environment Programme (UNEP), Nairobi. Australia Bangladesh, Fiji, Guyana, India, Malayasia and Sri Lanka participated in the project. Based on the investigations conducted at RRL, a process was developed to convert water hyacinth into good quality papers, boards and grease proof paper, and a fully integrated plant was established at RRL, Hyderabad. Based on the process a water hyacinth paper mill has been operating at the Rural Development Organization, Industrial Complex, Lamshang, Manipur, since 6 November 1989.

Water hyacinth (*Eichhornia crassipes*) is one of the most menacing aquatic plants having extremely high growth rate, which spreads rapidly, clogging drainage, ditches, shading out other aquatic vegetation. The disadvantages associated with the alarming growth rate have been transformed into an advantage by utilizing this plant as raw material for the manufacturing of paper and boards.

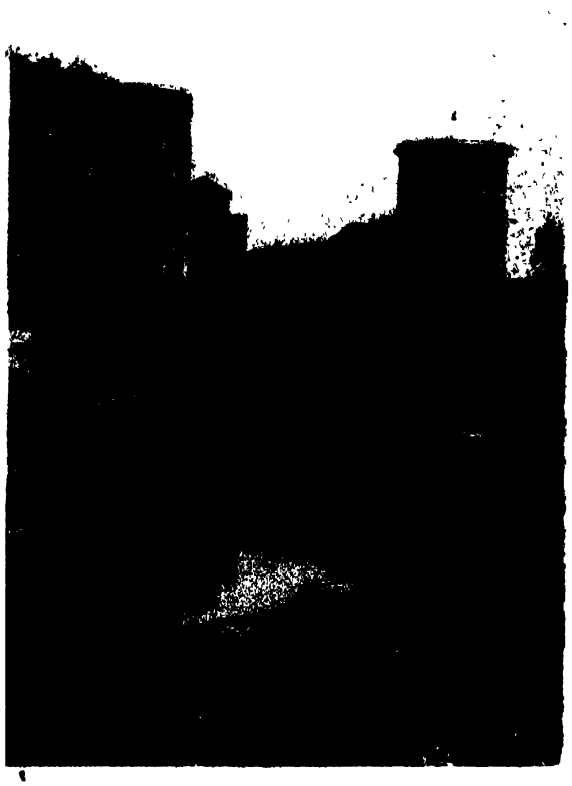
Equipment for Pollution Abatement in FBC Pilot Plant

The Regional Research Laboratory (RRL), Jorhat, has designed an 18-feet cycle separator and a 9-feet water scrubber as a measure towards pollution abatement in Fluid Bed Combustion (FBC) pilot plant. The equipment fabricated by the Metals and Equipment Co., Calcutta, and installed at the pilot plant site, can remove particulate material emanating from fluidized bed boiler and produce pollution free stack gas. Provisions for on-line monitoring of polluting gases like oxides of sulphur, carbon monoxide, oxides of nitrogen, etc. have also been made. The highly accurate stack gas monitoring devices were imported from M/s. Environment S.A., France and Fuji, Japan.

Oil Spill in Damodar River—CFRI and NEERI Carry out Water Analysis and Monitoring

Originating from the hills of Palamu District of Bihar, the Damodar river runs through the entire industrial-coal-steel belt of South Bihar and West Bengal, finally to empty into the Hooghly river. In its 540 km long course, it is the main source of water for domestic and industrial users in the Dhanbad-Giridih belt of Bihar and the Asansol-Durgapur region of West Bengal. There are some 46 large and medium industries on its banks, which include coal washeries, thermal plants, fertilizer and chemical plants, coke oven plants and a cement factory. In Bihar region alone there are about 25 small and medium towns along the river tract. All these industrial units and townships discharge pollutants into the river, making it one of the most polluted rivers of the country.

Already beset with pollution problems of high magnitude, the river had to suffer recently owing to a leakage of some 200 to 400 kilolitres of furnace oil into it, from the storage tanks of Bokaro Steel Plant. The furnace oil leaked out through the exit valves of the storage tanks of the Bokaro Steel Plant and flowed through underground drains into the river for full four days, from 2 to 5 April 1990, without being detected by the Bokaro Steel staff or the Jamadoba Pump House which pumps water to the twin coal towns of Dhanbad



Oil floating on Damodar river water

CFRI pumping station (left) and the railway pumping station at Damodar river, 5 km away from the CFRI lake (connected with pipeline), foreground shows the pool of river water highly contaminated with the spilled oil

and Jharia. It was the Management of Chandrapura Thermal Power Station, which pumps the river water into its coolants, detected the heavy contamination of oil in water and raised an alarm which exposed the disastrous situation. Till 6 April, a large quantity of oily water had been supplied throughout Dhanbad and Jharia areas. On detection of the leakage, the Jamadoba pumps were stopped, leaving the twin towns parched of water for the following 4-5 days. The Coal Mines Area Development Authority (CMADA), the body responsible for the supply of water to this vast area, started from 7 April, cleaning operations on a war-footing.

The Central Fuel Research Institute (CFRI), Dhanbad, whose office and colony of some 4000 residents receive water through the pump house situated a few kilometres down stream from the Jamadoba pump, immediately stopped the pumping of water on detecting the oil slick at the laboratory's pump head. A barricade was erected at the pumping site to arrest the oil intrusion. Thus the chocking of the treatment plant could be avoided.

Also, CFRI, being a premier research laboratory in the area, established inter-organizational rapport with CMADA, Bihar Pollution Control Board, Central Mining Research Station, Bokaro Steel Plant, National Environmental Engineering Research Institute, etc. A meeting was held with members of some of the above organizations for formulating actions to avoid the impending crisis and to monitor the quality of water by regular sampling.

Water and oil samples were regularly collected from different points by both CFRI and CMADA. The Calcutta Zonal Laboratory of NEERI carried out physico-chemical and biological analysis of the water samples.

With the flushing of water by the Damodar Valley Corporation, from the Tenughat Dam, the condition came under control. The NEERI Zonal Laboratory has recommended that the water monitoring programme in the region should be taken up as a continuing activity.

World Environment Day Celebration at ITRC

The Industrial Toxicology Research Centre (ITRC), Lucknow, celebrated World Environmental Day on 5 June 1990 by arranging an elocution contest on the theme Children and the Environment', a meet of eminent scientists to exchange views on environmental issues and an exhibition. The 20 children who participated in the elocution contest stressed the need for dissemination of information at school level for effective understanding of environmental im-

At the World Environment Day function at ITRC, Lucknow, seen on the dais (from left) are: Dr K.P. Pandya, Rev Father P Rodrigues, Dr P.K. Ray, Dr Nityanand, Dr Devika Nag and Dr N. Sen

balances. A slogan competition was also organized.

Addressing the scientists meet, Dr P.K. Ray, Director, ITRC, said that indifference towards the environment poses a major threat to the survival of the future generations. One of the major dangers is 'Green house effect' caused by increasing levels of sulphur dioxide, carbon dioxide, methane gas and chlorofluoro carbon compounds in the atmosphere of the earth. The carbon dioxide concentration has gone up from 270 ppm 10,000 years ago to its present level of 350 ppm. It is believed that these changes have taken place primarily due to the burning of wood, fossil fuel, coal and oil, and also due to destruction of tropical forests. Every tonne of burning coal is estimated to produce 4 tonnes of carbon dioxide. About 6000 million tonnes of coal are burnt annually. Burning of oil and gas and rapid deforestation together contribute about 40 gigatonnes of carbon dioxide in the atmosphere every year.

Dr Nityanand, ex-Director, CDRI, in his presidential address, emphasized that there should be a strong initiative by people themselves to conserve and preserve environment. Dr Devika Nag, Head, Neurology Department, KGMC, Lucknow, cautioned about the indiscriminate use of pesticides leading to neurological disorders and stressed on proper handling and disposal of pesticides. Shri N. Sen, Adviser - Planning, CSIR, said that proper planning to safeguard against possible ecological imbalances due to newly set up megacomplexes is a must. Rev. Father P. Rodrigues, Principal, St. Francis College, suggested that environmental sciences be included in school syllabus at an early stage. He strongly felt that some practical exercises, indoor and outdoor, be made mandatory from class VI onwards.

Proposing a vote of thanks, Dr K.P. Pandya, Chairman, World Environment Day celebration, said that environmental concerns include the international problems of acid rain, the greenhouse effect and depletion of planet's ozone layer. He concluded by saying 'Let us think globally on environment and act locally to preserve it'.

The poster and gadget exhibition arranged on the occasion displayed Bact-O kill, Amrit Kumbh, water filters and water testing mobile van designed and fabricated by ITRC.

Bangladesh Extension Officers' Visit to PTC-Hyderabad

The National Institute of Entrepreneurship and Small Business Development (NIESBUD), New Delhi, under the Ministry of Industry, organized an International Programme on Entrepreneurship Development for Small Business Trainers/ Promoters, from 26 June to 18 August 1990. As a part of the programme, a group of 10 extension officers from Bangladesh, of which seven were women, visited the CSIR Polytechnology Transfer Centre (PTC), Hyderabad, on 25 July 1990. The Bangladesh team representing Small and Cottage Industry Corporation, was accompanied by NIESBUD's Training Officer, Shri Rishi Raj Singh. The objective of the programme, according to Shri Singh, was to equip the officers with indepth knowledge about technology opportunities and technology transfer problems, with a view to enabling them to organize an effective Entrepreneurship Development Programme in their country. He felt that PTC (Hyd) was the most appropriate Centre in Hyderabad for this purpose.

In general, the participants were looking for project ideas, resource-based technologies, skill development-cum-training facilities, and technology transfer from India to their country. The visitors briefly explained the status of local resources and skills available in their areas of operation. Prof. B.R. Sant, Scientist-in-Charge, PTC, Hyderabad, explained the role and functions of CSIR, PTC-Hyderabad, national

laboratories, and NRDC, and described some of the technologies relevant to small and cottage type industries. The illustrated profiles provided by Prof. Sant created tremendous interest amongst the participants and some of the participants wanted more details on certain specific projects. The participants expressed their deep appreciation and gratitude to the officers of PTC-Hyderabad for their assistance and guidance.

PROGRESS REPORTS

CEERI Annual Report : 1988-89

The major thrust areas of R&D programmes of the Central Electronics Engineering Research Institute (CEERI), Pilani, according to its annual report for 1988-89 are: 1. Microelectronics and Power Semiconductors, covering LSI/VLSI technology; multilayer hybrid microcircuits, power transistors for transportation and millimetre wave impact diodes; 2. Microwave Tubes; and 3. Industrial Electronics including microprocessor-based PWM AC motor drive for electric vehicles, microprocessor-based distributed digital process control systems for sugar industry, microprocessor-based process control instrumentation for pulp, paper and wood-based industries (project taken up at CEERI Centres at New Delhi and Madras), voice communication with machines and museum electronics (CEERI Centre, New Delhi). The basic research pursued at the institute includes: 1. Mathematical Modelling and Computation Study of Sugar Crystallization, 2. Sub-threshold Behaviour of Fine Line Geometry MOS Devices; 3. Ga-As Devices; 4. High Tc Superconductors - the study includes growth of bulk and thin film materials and superconducting microelectronic devices; 5. Optical Lithography; 6. Thin Films and Metallization and 7. Mathematical Modelling and Computer Simulation for Microwave Tubes.

The laboratory has developed a number of electronic systems for sugar and allied industries. For sugar industry it has developed Temperature control, Pan monitoring, and Juice evaporation control systems, and oxygen sensors for monitoring the boiler efficiency.

An important variable which needs continuous measurement and monitoring in the sugar and allied industries is the temperature, since it not only affects the final product but also, if properly controlled, can lead to considerable energy saving in the plant. There are about 65 such points in a typical sugar plant which need measurement, indication, monitoring and control in order to optimise sugar recovery and reduce energy consumption.

The MICRO-TEIMAC system, developed by CEERI under a partially funded project of the Department of Electronics, was successfully field-tried at the Kisan Sahakari Chini Mills Ltd, Anoopshahar, U.P. and M/s K.K. Wagh Sahakari Karkhana, Maharashtra. The system can accurately make temperature resolution of 0.1°C, corresponding to 4 microvolts in sugar factory environment at a distance of 100m. Such resolution is suitable for digital control applications in industry. Apart from optimising temperature dependent processes in sugar production, the system leads to an energy saving of 2%. The basic system is suitable for other industries also, e.g. cement, food, distilliaries, etc.

Sugar crystallization process in sugar industry is one of the most critical process steps leading to the formation of crystals in vacuum pans. CEERI's MIPMOS system is meant for use in pan boiling stage in sugar industry. The system, along with sensors and transmitter was commissioned and field tested at Kisan Sahakari Chini Mills and K.K. Wagh Sahakari Karkhana. The unit computes on-line and displays pan parameters such as brix, purity and degree of supersaturation of the C-massecuite strikes on the basis of on-line data acquisition of a.c. resistivity, viscosity, temperature and level of the massecuite in the pan.

The juice flow stabilization system, including hardware, software, control valve and drivers, was designed and prototype of an integrated system was tested in the laboratory under simulated conditions. Work on field trials was initiated in a commercial sugar factory.

Because of the potential advantages of AC motors, the variable frequency inverters for AC motor drives are becoming increasingly popular. The 50 kVA variable frequency 3-phase transistor inverter designed and developed at CEERI consists of following three main submodules: six-step logic, 3-phase transistor inverter and control logic for safe operation. The possible uses of the motor drive being explored are in: Air conditioning units running on higher compressor speed, Compact and light weight uninterrupted power supply system and transportation.

A Monolithic Power Darlington Transistor was developed for electronic power control systems, and was being tried in the CEERI PWM AC motor drives for electric vehicles. The transistor exhibited superior electrical performance over the commercially available devices. Salient features of the device are: low saturation voltage and high safe operation area.

Fabrication of a VME bus compatible controller chip for multichannel data acquisition was carried out successfully under the project on AC motor drive system. The chip contains about 800 components on a die of 4.3 × 4.3 mm^2 size. The chips are encapsulated in

48 lead ceramic dual-in-line package. The fabrication is based on indigenously developed 6μ silicon gate NMOS process. This integrated circuit passed all the specifications and was being used by the Systems Group. A controller chip, having 3000 components, for 16 bit processor (for PWM generation) for AC motor drive system was being fabricated.

Three different types of hybrid microcircuits (HMCs), viz. relay driver-1, relay driver-2 and remote decoder (multilayer) were developed for the INSAT-II project. After screening at ISAC, Bangalore, these devices are being used for ETM model. Also, 11 HMCs which can handle high powers up to 24W were developed and handed over to the Systems Group for inhouse user's trials.

Under its project on development of superconducting microelectronic devices, the institute achieved highest Tc (zero) of 90K in a fluorine implanted Bi-Sr-Ca-O superconductor, fabricated superconducting films of bismuth cuprate on alumina substrate (Tc = 75K), and developed a technology for making sputtering target of ceramic oxides. Exact one, two and three compositions in sputtered thin films of yttrium oxide were also obtained. D.C. Josephson effect was observed at and above LN2 temperature in weak links fabricated on fluorinated bismuth oxide bulk samples.

Mask making facility was utilized for completion of 37 jobs which included full process masks, contact prints, rubylith masks and microphotography. About half a dozen mask sets were given to users outside CEERI. The first version of mask making expert system was developed on PC/Turbo Prolog and given to BEL- Bangalore for user trial. The first version of optical lithography simulator 'ANKAN' was compiled on UNIX system and given to University of Poona and IIT-Bombay.

In the area of Microwave Tubes, emphasis was laid on the development and performance evaluation of Type-B dispenser cathodes, and standardization of various processes/techniques used in the fabrication of standard Type-B cathodes. Four/five batches of these cathodes were fabricated with potted heater design; and elaborate performance tests including emission poisoning, reactivation behaviour, extrapolated life tests, etc. were carried out. The performance of the cathodes was found to be quite stable and at par with the equivalent imported cathodes. The d.c. emission capability of these cathodes is 2-3 A/cm and the pulsed emission capability better than 6 A/cm at 1400 K. The bulk porosity is 18% and impregnant composition is 5 BaO : 3 CaO: 2 Al_2O_3.

For fabrication (batch production) of these cathodes, most of the processes/techniques like decoppering of pellets, impregnation of pellets, heater potting and sintering, brazing of cathode pellets, etc. were standardized.

A grant-in-aid project of Rs 9.5 million was approved by the Department of Electronics for the development of more advanced cathodes (Type-M dispenser cathodes). Work on this project was going on. A d.c. sputtering system was specially designed and fabricated for these cathodes. A high vacuum pump system based on oil diffusion pump was modified, reassembled and attached with the above sputtering module to conduct initial trials on sputter deposition of W-Re-Os metals, etc. The system worked satisfactorily. As a result, some of the basic operating parameters like substrate to target spacing, anode current target voltage/current, deposition rate, uniformity of film thickness, etc. were established.

As the sputtering target metals and alloys are extremely costly and not available in certain cases, concerted efforts were made to develop these targets in smaller sizes by powder metallurgy techniques. A few tungsten and tungsten-rhenium targets were fabricated. Similarly, some of the unconventional high temperature brazing alloys (like Moly-Nickel entectic, etc.), not available commercially, were made and used successfully for brazing tungsten cathode pellet with moly sleeve.

Work on the development of a Thermionic Emission Microscope (THEM) was also initiated.

Other projects in the microwave tube area related to: Distributed emission crossed-field amplifier, power TWTs, MM wave magnetron. BEL-Bangalore sponsored a project for the development of an S band, 30 W pulse TWT. Also, the company started production of 1 kW D/E band CW klystron using the CEERI knowhow.

Studies were made on the development of fast warm-up cathode structure. The feasibility of using Nimonic 80-A, with nickel powder sintered over it as base of oxide coated cathode, was established. In the test diodes at cathode brightness temperature of 775°C, maximum space charge limited current density of 400 μA/cm and saturated current density of 600 μA/cm were achieved under CW condition, while under pulsed condition (pulse width 3.0 μs and duty ratio 0.001), the corresponding values were 5.0 and 8.7 A/cm respectively. The thermionic emission characteristics of this type of cathode compared well with that of an oxide coated cathode using special nickel alloys at its base. Warm up time of cathode in test diodes was found to be less than 5s with heater programming.

The major R&D activities of the CEERI Delhi Centre related to Museum Electronics, Audio Visual Systems and Adult Literacy Mission; Audio Visual Software;

Speech Communication Systems and Knowledge-based Voice Recognition, and Synthesis Systems. The ongoing project to assist the National Museum of Natural History was completed. The following systems were completed and installed: An information system which can be used by visitors to obtain specific information concerning exhibits/galleries, and Animation for a diaroma highlighting industrial pollution.

A Centre for Development of Electronic Systems (CDES) as one of the Appropriate Automation Promotion Centres (AAPC) under Department of Electronics functions at the CEERI Madras Centre. R&D activities of CDES, during the year related to: Digester control instrumentation/Digital controllers for wet end instrumentation; Field trials of 'O' frame instrumentation and Locomon; Brightness, Moisture, and Real-time consistency/viscosity and tensile strength monitors.

Under its in-house projects, the Madras Centre pursued projects on: PC-based rheometer for the rubber industry, and Microprocessor-based control system for tannery wet operations (in collaboration with the Central Leather Research Institute, Madras).

NEW PUBLICATIONS

Chemistry and the Environment: Proceedings of Regional Symposium, Brisbane, 1989

Technological developments which have led to the improvement of the quality of human life on earth are now threatening the very existence of mankind owing to their adverse effects on environment. The environment around us depends on many interactive physical, chemical and biological processes. Therefore, an understanding of all the processes has many-fold ramifications and implications. To have an understanding of the chemistry of the environment, the Commonwealth Science Council, in cooperation with the Federation of Asian Chemical Societies, UNESCO and other regional and international agencies, organized a two-day Regional Symposium on Chemistry and the Environment, in Brisbane, Australia, during 1-2 September 1989.

The title publication (published by: Commonwealth Science Council, editors: B.N. Noller and M.S Chadha, printed by: Publications & Information Directorate, New Delhi), is a compilation of eighteen articles included in the proceedings of the symposium. Contributed by distinguished scientists from Australia, Canada, New Zealand, UK, Malaysia and India, the articles provide up-to-date information on various aspects of the fossil fuels utilization, ozone hole, green house gases and effects, environmental effects of several chemicals; atmospheric and urban air modelling, major chemical accidents and environmental monitoring aspects. Examples of the topics covered are: Interactive processes in the atmospheric environment; The international geochemical mapping project — A contribution to environmental studies; Photosynthesis and the green house effect; Ozone puzzles - Will a hole occur outside polar regions?; Urban air pollution modelling, etc. The publication was released simultaneously in London by Prof. M.G.K. Menon, Minister of State for Science and Technology, and in New Delhi by Dr A.P. Mitra, Director General, CSIR, on 13 July 1990.

The essential idea in publishing the proceedings is to catalyze activities in the Asia-Pacific Region which not only faces the same problems as the rest of the globe but also has to contend with high population and uncontrolled generation of pollutants. The proceedings could help in the for-

Shri Moni Malhoutra, Assistant Commonwealth Secretary-General, receiving a copy of the publication 'Chemistry and the Environment' from Prof. M.G.K. Menon, Minister of State for Science and Technology. Also seen are (l to r) Shri N. Slade, Assistant Director, Legal Division, Commonwealth Secretariat, Dr J S. Bow, Secretary-General of the Royal Society of Chemistry and Dr G. Thyagarajan, Secretary, CSC

mulation of effective strategies for containing environmental problems.

The volume should be recommended reading for scientists, meteorologists, technology managers, policy planners, industrialists and futurologists.

The publication (pp 324+xii, price Rs 125, $ 45, £ 30) can be had from the Senior Sales and Distribution Officer, Publications & Information Directorate, Hillside Road, New Delhi - 110012.

Bouguer Gravity Anomaly Map of Cuddapah Basin

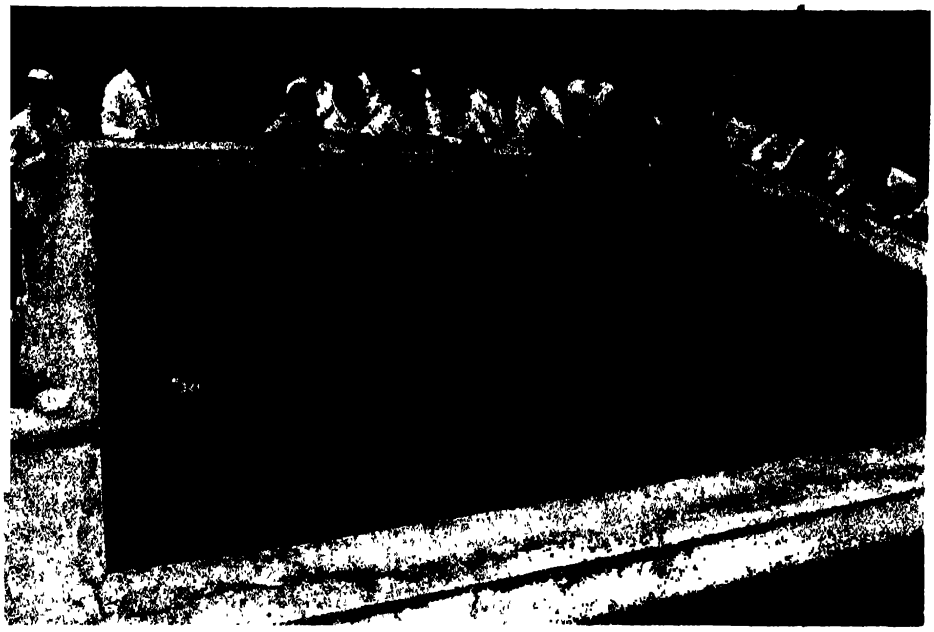
The National Geophysical Research Institute, Hyderabad, has brought out an up-dated Bouguer Gravity Anomaly map of Cuddapah Basin (NGRI/GPH-6) at a scale of 1:250,000 in four sheets. The map is expected to serve as a compatible companion to the geological map of Cuddapah Basin (in four sheets) published at the same scale by the Geological Survey of India. The map has a contour interval of 5 mgal and is based on the IGSN 71 system. These maps are available for sale together with an explanatory brochure (with 16 figures and 5 tables) which describes the characteristics of gravity data, methods of their reduction, compilation of the gravity anomaly map, density data and interpretation.

The price of the gravity anomaly map (in four sheets) together with the explanatory brochure is Rs 79.00 ($ 25), excluding forwarding and postage charges, and can be obtained by sending a demand draft in the name of the Director, National Geophysical Research Institute, Uppal Road, Hyderabad - 500007, India.

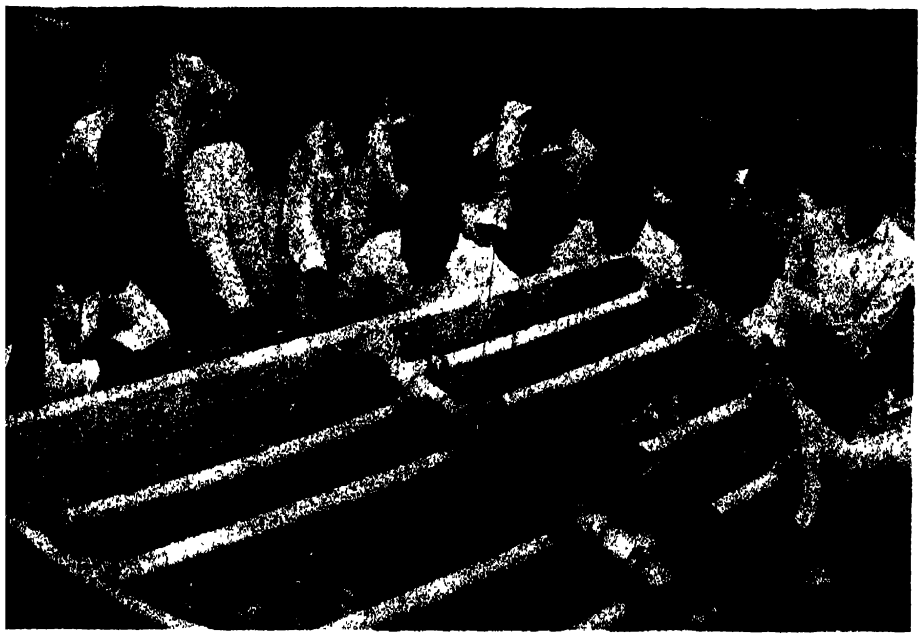
TRAINING COURSES

NEERI Training Programmes on Water Purification

The Government of India's 35-Point Action Plan for the various sectors of development contains a sector on S&T which has identified a list of projects and activities to be implemented during the coming years. The emphasis is on S&T inputs for poverty alleviation, water management, employment generation training, and programmes for health and development of indigenous technology. Under the programme component 'Training of Trainers for a variety of Vocational Trades in Rural Areas', coordinated by CSIR, the National Environmental Engineering Research Institute (NEERI), Nagpur, was assigned four training programmes on excess iron removal and fluoride removal from and slow sand filtration and disinfection of water.



Participants of the Training Programme held in Nagpur, being shown the slow sand filtration plant at Borujwada



Participants at the training camp for demonstrating water purification, excess iron removal and sanitation techniques, at Gadchiroli, Maharashtra

These programmes were to be conducted in 1990- 91.

Of the four programmes, two were held earlier — one at Ongole in Andhra Pradesh and the other at Rajura (Chandrapur) in Maharashtra. The rest two were held at Gadchiroli and Nagpur.

The programme at Gadchiroli was organized in collaboration with the Zilla Parishad, Gadchiroli, on 15 May 1990.

The one-day training camp demonstrated the modern techniques of water purification, excess iron removal and sanitation, to the tribals and user agencies in that district.

The training programme was attended by 97 participants. Shri S.M. Kasbekar, Additional District Collector, inaugurated the programme and Shri K.G. Rohee, Additional District and Session Judge, was the Chief Guest. NEERI team delivered lectures on water quality, disinfection, sanitation and iron removal, demonstrated iron removal technology at the plant site and showed video films.

The training programme at Nagpur (12 July 1990) was on slow sand filtration; 43 engineers from the Public Health Engineering Departments/ Water Supply Boards of the States of Karnataka, Andhra Pradesh and Maharashtra participated. The highlights of the programme were: a brief introduction by Shri K.R. Bulusu, Deputy Director, NEERI, on the genesis of the programme and a lecture on disinfection of water for potable purposes. This was followed by a detailed presentation by Dr R. Paramasivam, Assistant Director, NEERI, on Slow Sand Filter Design, Construction, Operation and Maintenance, and a lively discussion by the participants. A field visit to the slow sand filtration demonstration plant at Borujwada, near Nagpur, was also organized.

At the conclusion of the programme, Prof. P. Khanna, Director, NEERI, gave away certificates to the participants. Dr (Smt.) N.P. Thakkar, Scientist, NEERI, conducted the proceedings.

Honours & Awards

G.M. Modi S&T Award for Prof. R. Narasimha

Prof. R. Narasimha, Director, National Aeronautical Laboratory, and currently Jawaharlal Nehru Visiting Professor of Engineering at Cambridge, has been given the third Gujar Mal Modi Science and Technology Award - 1990, for his outstanding contributions to innovative science. He received the award at the hands of the Vice President of India, Dr S.D. Sharma, on 9 August 1990.

Prof. Narasimha is internationally known for his contributions in aerospace science and engineering, especially in fluid mechanics and aerodynamics. He has also worked in other areas like airworthiness analysis, nonlinear problems, and atmospheric sciencies.

Prof. Narasimha is recipient of many honours and awards. Notable among them being the Burmah Shell Award of the Aeronautical Society of India (1970), Shanti Swarup Bhatnagar Prize in Engineering Sciences (1976), Homi Bhabha Award for research in applied sciences (1976), Shanti Swarup Bhatnagar Medal of INSA (1985), California Institute of Technology Distinguished Alumni Award (1986) and Karnataka Rajyotsava Award (1986). In 1987, he was conferred on the Presidential Honour, Padma Bhushan.

He was Sherman Fairchild Distinguished Scholar at the California Institute of Technology, during 1982-83, and Clark B. Millikan Visiting Professor of Aeronautics at the Institute, for two months (April-May) in 1985. He was nominated to the Science Advisory Council to the Prime Minister for two years in 1986.

Speaking at the prize-giving ceremony, the Vice President said that scientific and technological development should be directed towards the welfare of the society. Stating that science had made great progress in all fields, Dr Sharma stressed the need to recognize scientists' works and honour them. Speaking about the 'brain drain', he said that the scientists did not go to other countries for the sake of money but because of the better conditions and environment prevailing in those countries.

He advised that more such awards should be instituted to encourage the Young Scientists. Not only the industrial houses and the government but also the society should come forward to honour the scientists and give recognition to their work, Dr Sharma added.

Speaking on the occasion, Prof. M.G.K. Menon, Minister of State for Science and Technology and Vice President, CSIR, said that research and development should be promoted and proper environment should be created for scientists to work for growth.

The Information and Broadcasting Minister, Shri P. Upendra presided over the function.

Dr R.V. Chaudhari

Dr R.V. Chaudhari, Scientist, National Chemical Laboratory, Pune, has been selected for the second prize of 'Hari Om Ashram Prerit Shri S.S. Bhatnagar Research Endowment 1988 on Catalysis', for his outstanding contributions in the area of homogeneous catalysis. The prize carries a cash award of Rs 3000.

PATENTS FILED

308/DEL/90: A process for the prepartation of arbortristoside A, arbortristoside B, arbortristoside C, arbortristoside D, arbortristoside E and 6-hydroxy loganin from the seeds of the plant *Nyctanthes arbor-tristis*, J.S. Tandon, P.Y. Guru, V. Srivastava and S. Bhatnagar — Central Drug Research Institute, Lucknow.

ANNOUNCEMENTS

National Seminar on Substitutes for Wood in Buildings

The use of timber in building industry is gradually becoming restricted due to its increasing price and scarcity. It has become imperative to preserve forests for ecological reasons. The staggering problem of housing shortage and compounding of the backlog every year cannot be overcome without break-through in finding suitable substitute for timber. According to an estimate of FAO, the total requirement of wood in Indian industry is 12 million tonnes while supply is only 5.7 million tonnes. About 25- 30% of this total supply of timber is being consumed for building and housing sector which amounts to about 12 to 14% of the cost of total building materials used in a building.

Realizing the scarcity of timber in building and construction, the Research Advisory Committee of the Ministry of Urban Development recently laid emphasis on the development of alternative materials as substitute for wood, in the 8th Five Year Plan, which naturally calls for special attention to carving out strategies for future development in this direction. Recognizing the high national relevance of the area, the National Standing Committee on Plastics in Buildings, constituted by the Central Building Research Institute, Roorkee, in 1987 and the Building Materials Group of Materials Research Society of India are jointly organizing a National Seminar on Substitutes for Wood in Buildings, during April 1991. The aim of the symposium is to discuss new approaches for finding suitable alternatives of wood in buildings and also to bring together researchers, industrialists, builders and architects on one platform to work on wood substitutes in building and construction

Original papers presenting new researches, developments and applications, on the following topics are invited: polymeric building materials; fibre reinforced composites; sandwich type composites; ferrocement and other inorganic products, material properties, standardization and durability aspects; and energy conservation and pollution control through alternative building materials. Abstracts of the papers (500 words) may be sent to Dr R.K. Jain, Organizing Secretary, National Seminar on Substitutes for Wood in Buildings, O.B.M. Division, CBRI, Roorkee - 247667, by 31 October 1990. Full text of papers, after acceptance, will be required to be submitted by 31 December 1990. The consent along with participation fee of Rs 700 (Rs 500 for MRSI members) may be sent to the Organizing Secretary by 30 September 1990 through bank draft drawn in favour of the Director, CBRI, Roorkee.

CFTRI Training Courses

The Central Food Technological Research Institute (CFTRI), Mysore, will be organizing the following training courses/workshops in the coming months: Alcoholic Beverages — Manufacture and Quality Control for Excise Officials (1-12 October 1990), Baking Science and Technology (22 October - 1 November 1990), Technology of Fruit and Vegetable Products (5-30 November 1990), Abattoir Practices and Meat Handling (3-14 December 1990), Assessment of Microbial Quality of Water for Food Industry (17-21 December 1990), Workshop on 'Food Packaging, Corrugated Fibre Board Boxes' (24-28 December 1990), Technology of Storage, Processing & Quality Control of Foodgrains (31 December 1990-11 January 1991), Orientation Programme for Departmental Field Staff (14-28 January 1991), Workshop on Organisation and Management of Food Industries (4-9 February 1991), Solid State Fermentation (11-22 February 1991), Technology of Storage, Processing & Quality Control of Foodgrains (11-15 February 1991), Supercritical Fluid CO_2 Extraction Application in Food Industry & Design Process Plants (25 February - 1 March 1991), Orientation in Caramels and Toffee Making (25 February - 1 March 1991), Aflatoxin Analysis (25 February - 1 March 1991), Flexible Packaging of Foods (25 February - 1 March 1991), Technology of Storage, Processing & Quality Control of Foodgrains (18 March - 12 April 1991), Developments in Oilseed Processing & Quality Assurance for Edible Oils & Meals (15 April - 10 May 1991).

Further details regarding these courses/workshops can be had from: The Director, CFTRI, Mysore - 570013.

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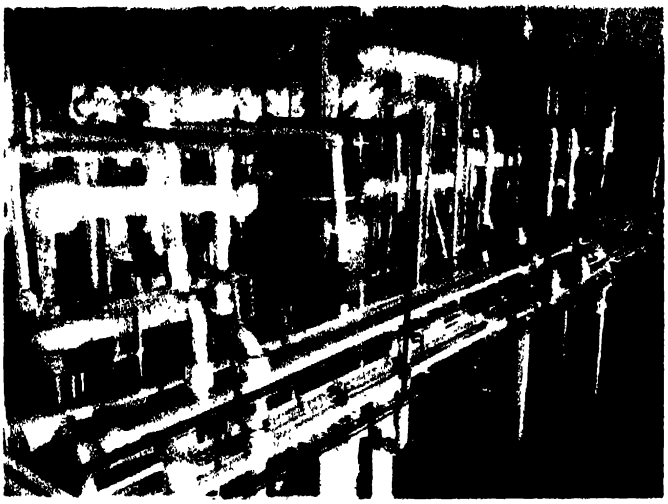
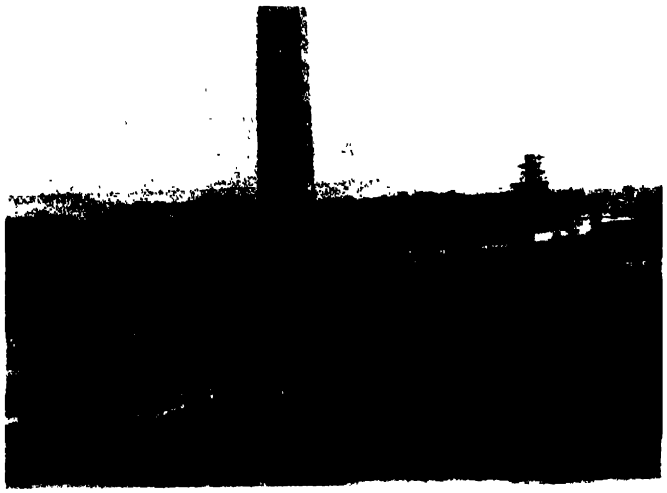




Presented in this issue are some significant achievements of the past year. The photographs show (clockwise from top left): CIPLA's etoposide plant based on IICT technology; Bamboo coaxed to flower *in vitro* Hindustan Polymers' ethylbenzene plant based on Albene Technology developed by NCL and HP; and 'Kumbraj' coke oven for production of metallurgical coke from low volatile medium coking coal

CSIR's Contribution to S&T - Some Highlights

Constituted in 1942 with the aim of promotion, guidance and coordination of scientific and industrial research in India, the Council of Scientific & Industrial Research has completed forty-eight years in September this year. During these years, the Council has helped establish a sound S&T base in the country and has rendered valuable service to the Indian industry.

Some of the significant achievements/activities of the Council during the last year (Sep.1989-Sep.1990) are highlighted here:

Albene Technology for Production of Ethylbenzene

The Hindustan Polymers (HP), a unit of McDowell and Co. Ltd of the United Breweries Group, commenced commercial production of ethylbenzene from ethyl alcohol and benzene in its 12,000 tonnes/annum plant at Visakhapatnam, based on the 'Albene Technology'. Three institutions were involved in the development of the technology. The National Chemical Laboratory (NCL), Pune - the R&D organization which developed the Encilite-2 catalyst for the process; UCIL - which manufactured the catalyst for the user industry; and HP - who manufactured ethylbenzene based on the catalyst. Ethylbenzene is a key intermediate for styrene used in manufacture of plastics and synthetic fibres.

The most significant advantage of the Albene technology is that it uses ethyl alcohol rather than ethylene, as the starting material. Use of alcohol, produced from the agricultural resources (e.g. molasses) is of great importance for India which has a predominant agricultural base.

Another major advantage is that the production of ethylbenzene takes place in a single step. In the conventional two-step process, alcohol is first converted into ethylene which is then reacted with benzene to obtain ethylbenzene, leading to about 10% energy saving. The superiority of the technology is likely to result in a saving of Rs 10 million on a production of 12,000 tonnes of ethylbenzene, in terms of material and energy. Also, the technology being totally indigenous, the need for importing gaseous solvents and catalysts has been eleminated, resulting an additional saving of Rs 10 million in foreign exchange.

Commercial Plant for Sodium Azide

Sodium azide is used as an intermediate for the preparation of lead azide - a primary explosive and detonator. Its more recent applications include the manufacture of automobile safety air- bags, fungicides, etc. The Indian Institute of Chemical Technology (IICT), Hyderabad, had earlier developed a process for this chemical. In 1988, Parsin Chemical Ltd, a company set up by Non-Resident Indian approached IICT for acquiring the know-how and design for a one tonne/day plant at Hyderabad. The project was conceived primarily for exporting the product to USA and had to meet the specifications laid down by the US Defence Department.

Extensive pilot scale studies on an updated process yielded material which fulfilled all the criteria for consumer acceptability. The plant was designed and commissioned by IICT in November 1989, which was erected at a cost of Rs 15 million. Commercialization of the technology is a significant achievement of IICT, since USA, Canada and Japan are the only other countries producing sodium azide for the US market.

The Analgesic Drug, DPH

A process developed by the Central Drug Research Institute (CDRI), Lucknow, for the production of Dextropropoxyphene hydrochloride (DPH), an analgesic drug, was successfully upscaled and used for commercial production by the Wockhardt Private Ltd, Bombay, at its Aurangabad plant. Utilization of the indigenous technology by the firm has effected foreign exchange saving through export substitution, and its export to 11 countries has led to a foreign exchange earning to the tune of over Rs 10 million/annum.

The firm earned the distinction of being first in India and fourth in the world, next only to USA, Switzerland and Italy, to have manufactured the drug from the basic stage.

The Anti-Cancer Drug— ETOPOSIDE

Etoposide is a synthetic derivative of the potent antimitotic natural product, podophyllotoxin which is a naturally occurring lignane isolated from *Podophyllum emodii* (a plant of Indian origin) and *P. peltatum* (found in North America). It is being widely used as an anti-cancer drug both in Europe and U.S. The conversion of podophyllotoxin to etoposide is a chemistry intensive process and involves several steps. The Indian Institute of Chemical Technology, Hyderabad, perfected the entire technology for the production of the drug and

demonstrated the process to CIPLA Ltd, Bombay, the sponsor. If manufactured in India, the cost of production of the drug is likely to be much less compared to the international cost. Also, the drug has a great export potential.

Bamboo Coaxed to Flower *in vitro*

The propagation of bamboo is beset with inherent difficulties owing to the unpredictable flowering and seeding behaviour. The flowering of bamboo is gregarious and most of the bamboo species flower only once in their lifetime (i.e. when they are 12-120 years old) and after this rare event the entire forest dies. The normal seed generation time being so long and unpredictable in these plants, it has not been possible to mix the genes of different plants for evolving superior offspring.

Realizing these problems, the National Chemical Laboratory, Pune, devised a brew using the tissue culture method, that spurs young bamboo plants of three species to flower prematurely within a few weeks, which under the normal circumstances takes several years. It is a breakthrough that will have tremendous potential in the breeding of bamboo to fashion novel hybrids which will grow faster, resist diseases and yield a stronger and more versatile wood. With further refinements in the technique it may be possible to obtain a perennial source of seed. By studying the events leading to flowering under controlled conditions, it may also be possible to solve the mystery behind the unpredictable flowering behaviour of bamboo.

Demonstration SQUID based on High Temperature Superconductor

Superconducting Quantum Interference Device (SQUID) has unsur-

Excerpts from the Prime Minister Shri Vishwanath Pratap Singh's address to the CSIR Directors' Conference(New Delhi, 28 March 1990)

"With a network of 40 research laboratories and around 100 extension centres and field stations, CSIR is our premier R&D organization, of which the country can be proud of. Over a period of time, the Council has built a vast reservoir of scientific talent and nurtured a vast infrastructure for research and development. It is therefore quite natural that the country would expect CSIR to contribute to the national development in a greater measure. We are looking to the scientific community, particularly the CSIR, to come up with new breakthroughs in our fight against poverty and backwardness. I am happy to note that the Council has further sharpened its focus and has been designated as the nodal agency for some of the programmes identified under the S&T Action Plan. It is my hope that your efforts in this direction would become a model worthy of emulation by other scientific organizations".

"One can hardly over-emphasize the need for integrating the network of CSIR laboratories with the whole economic and industrial activity in the country. Research and innovation have to play a very major role in industrialization today. There are many sectors in which the technological development has not kept pace with the needs of the economy. CSIR has a major responsibility for indigenous technological development with provision for continuous upgradation.

"Even when technology has to be imported, it is necessary to see that it is properly absorbed and adapted and that it leads to innovation. I learn that the industrial output from CSIR-based technologies is quite significant. While this is encouraging, still more needs to be done. More effective steps need to be taken for ensuring a better interaction between CSIR and the industrial sector."

"CSIR has to be at the forefront of the international science & technology in at least a few selected areas. These areas could be those in which we as a nation have a competitive advantage or where technology would be denied to us for commercial or political reasons. I understand that in areas such as petrochemicals, catalysts and drugs, CSIR is making significant strides. I am also pleased to learn that CSIR is exporting technologies to even the developed countries in some of these areas."

"I am happy to note that CSIR has realized the need for recognizing and nurturing excellence both inhouse and external. The introduction of Bhatnagar Fellowships for eminent and outstanding scientists in the country and Distinguished Fellows Award for inhouse scientists are steps in this direction. I hope that these efforts to recognize and reward merit will encourage creativity and excellence in the Council."

passed sensitivity for sensing magnetic field. SQUIDs based on low temperature superconductors have been used in a variety of applications such as small magnetic fields associated with heart and brain, prospecting of oil and minerals, non-destructive testing of cracks inside the body of ferromagnetic materials and ultralow frequency communication between a submarine and a ground base. However, most of these applications could not reach commercial level owing to the very low temperature (4.2 K) involved in the operation of these devices.

CSIR initiated a programme to develop a SQUID, which would operate at higher temperature (77K), by the end of March 1990. Four CSIR laboratories, viz. Central Electronics Engineering Research Institute (Pilani), Central Glass & Ceramic Research Institute (Calcutta), National Physical Laboratory (New Delhi) and Regional Research Laboratory (Trivandrum) were entrusted with the task. These laboratories developed a SQUID which operates at 77K, exploiting the earlier observation that the high temperature superconductors are granular in nature and the superconducting grains provide natural Josephson junctions at the grain boundaries.

The SQUID developed operates at about 20 MHz and has sensitivity of the order of 3×10^{-4} $\phi_0/\sqrt{Hz}$ above 100 Hz. ϕ_0 is the flux quantum (h/2e) and its value is 2.07×10^{-7} gauss cm^2.

Aeronomy Payloads for SROSS Satellite

The National Physical Laboratory (NPL), New Delhi, is developing the payloads: Retarding Potential Analyzer (RPA) and Energetic Particle Spectrometer (EPS), to be flown on SROSS-3 satellite. Of the two payloads, the RPA was selected for the SROSS-C Satellite to be launched in 1991. The other payload on this mission is the Gamma Ray Burst payload of the ISRO Satellite Applications Centre (ISAC), Bangalore.

The main objective of RPA payload will be to study the ionosphere and thermosphere of low latitudes. It will measure essential parameters like electron and ion densities and temperatures to characterize the ionosphere and its thermal state. It will also measure the heat input parameter, the suprathermal electrons.

The work on RPA payload fabrication along with its qualification to space standards is being carried out at NPL and ISAC. CEERI- Pilani and NAL-Bangalore are extending help to NPL in this project.

LCA Air Intake Model

The National Aeronautical Laboratory (NAL), Bangalore, designed and fabricated a 1:4.405 scale LCA air intake model, at the instance of Aeronautical Development Agency (ADA). The model is of complex geometry and makes extensive use of composite structure (using carbon fibre epoxy) with high strength steel as core material to keep the model fabrication effort and weight low.

The model was successfully tested in the ONERA (France) high speed facility and found totally satisfactory. It is learnt that ADA saved nearly Rs 20 million in foreign exchange as a result of the laboratory's effort in making this sophisticated model.

Design Packages for Navodaya Vidyalaya Complexes

Under the 'NV Complexes' programme, launched in 1987, more than 400 NV Complexes, one each in every district, are proposed to be established. The Central Building Research Institute (CBRI), Roorkee, was invited to be National Nodal Agency for accomplishing this multi-disciplinary project. A task force was created at CBRI for the effective management of the project, with the assistance of the institute's six extension centres.

Based on the space norms formulated by CBRI, modular designs have been developed for the school buildings keeping in view the horizontal and vertical expansions in the phased manner, land configuration, ease in construction and multiple use of space. All building spaces have been scientifically designed after studying the activity pattern, number of users, and illumination, ventillation and thermal comfort requirements. Appropriate/lowcost technologies developed by the institute have been incorporated in the construction of these complexes. Some of these technologies are: Designed brick masonry, Precast stone/concrete block masony, RC ribbed slabs for floors and roofs, RC plank flooring/roofing system, channel unit flooring/roofing scheme, Pile foundations and single stack system of plumbing.

Utilization of Fly Ash for making Wall Tiles, Acid and Abrasion Resistant Tiles and Stoneware Sewer Pipes

The use of fly ash for making pozzolanic cement, cement concrete, bricks, light weight synthetic aggregates and in the construction of roads and pavements is well known. The Central Glass & Ceramic Research Institute, Calcutta, investigated the possibility of using fly ash for making wall tiles, acid and abrasion resistant tiles and sewer pipes.

In case of wall tiles, fly ash, plastic clay, feldspar and talc were used for body preparation. Red lead, zircon, Rajmahal clay, barium carbonate, whiting, borax and boric acid, etc. were raw

materials for the glaze. The tiles developed conform to IS: 777 and can be used like glazed earthenware tiles on the walls of bathrooms, kitchens, underground subways etc.

For making acid abrasion resistant tiles, fly ash was used as a major raw material alongwith plastic clay, feldspar, talc and also small amount of zircon sand. The tiles made conform to IS: 4457 for acid resistant test, and can be used in the floors and tank lining to resist corrosion of chemicals acidic in nature. As these are abrasion resistant also, they may be used in coal washeries as clinker tiles, and other industrial floors which are likely to be damaged by abrasion.

A red clay with fly ash was used for making sewer pipes. Powdered grog was added to the body for reducing shrinkage and improving the drying and firing property. The samples passed IS specification of 1600 kgf/m in respect of crushing strength and were impervious.

Lowcost Polymeric Systems for Building Industry

One of the important uses of polymeric systems is in the form of adhesives for wood, PVC and cement and concrete, etc. Studies made at the Central Building Research Institute, Roorkee, on the synthesis and characterization of rubber modified cardanol polymeric system, revealed that in the rubber-modified adhesives, the rate of development of strength is faster in comparison to unmodified adhesives. These adhesives were found to have higher bond strength and superior moisture and boiling water resistance.

Studies were also made on the development of IPN type epoxy phenolic polymeric systems, their characterization and utilization. A simultaneous inter-penetrating (SIPN) type polymeric system was synthesized. Mechanical properties, chemical resistance and morphology of the IPN system were studied and compared with that of the epoxy resins. The results showed that the IPN system possesses better resistance than the epoxy resin.

Know-how for producing the IPN coating has been given to the following three parties for commercial exploitation: Krishna Products, Bombay; Panchsheel Paints, Bombay and Hari Om Construction and Waterproofing Co., Gandhi Nagar.

Planning of Mass Rapid Transit System for Delhi

The Central Road Research Institute, New Delhi, completed a sponsored assignment: Planning of Mass Rapid Transit System for Delhi, as consultant to Rail India Technical and Economic Services, on behalf of Delhi Administration The objectives of the study included: development of the transport sub-models for the base year (1981), projection of the passenger transport demands for the horizon year (2001) and recommendation of an overall mass rapid transit system.

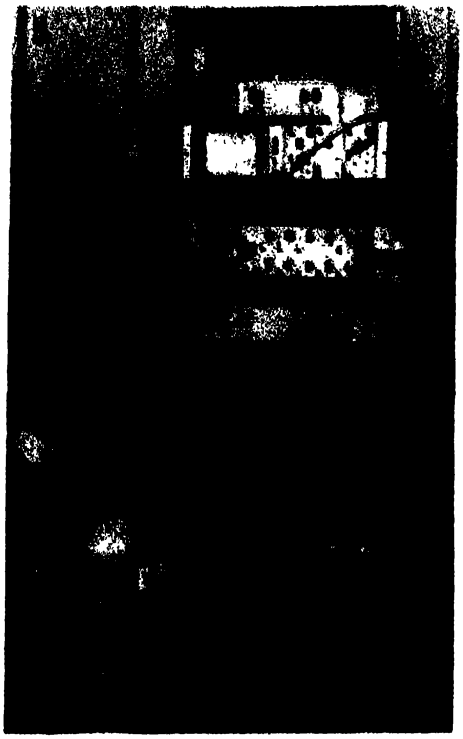
The four-stage transportation planning process, which included trip generation sub-models, trip distribution sub-models, model split sub-models and trip assignment sub-models, was utilized for this purpose. Simple and operable transport sub-models were developed for the base year and utilized for the projection of transport demand for the horizon year. A number of alternative transport networks consisting of road system only; road system and existing surface rail; road system, existing surface rail and metro; and road system and metro were considered and evaluated.

A mass rapid transit system was recommended which essentially consists of a multi-model system for roads, surface rail, metro and high capacity bus system. Priority segments were also recommended.

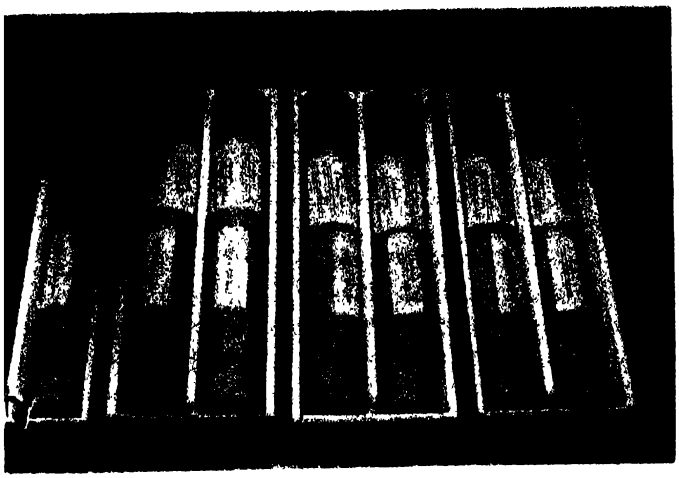
Wear and Friction Studies on Advanced Ceramics

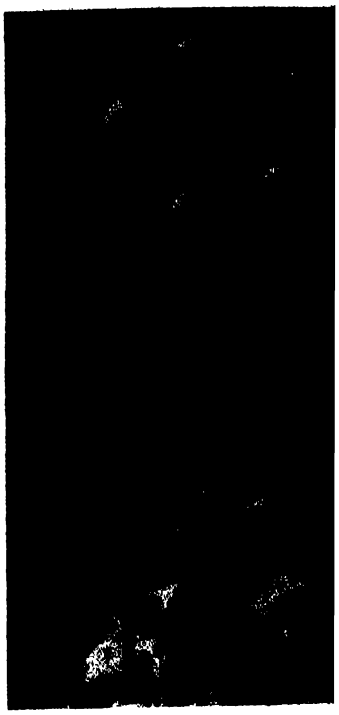
The Central Glass & Ceramic Research Institute (CGCRI), Calcutta, was assigned a project by the Aeronautical Research and Development Board, to study the wear and friction of advanced ceramics based on silicon nitride and composites, sialon, titanium nitride, silicon carbide and zirconia-based products.

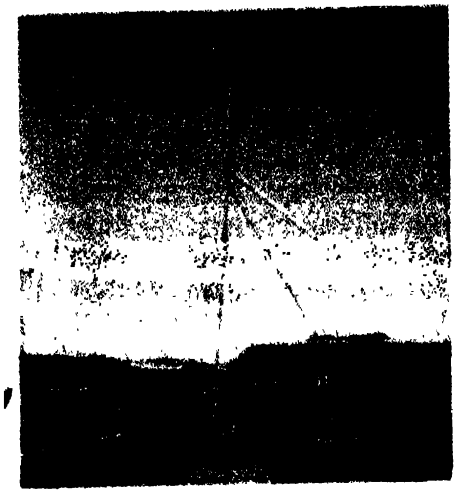
Wear and friction studies were carried out on sintered and hot press advanced ceramics under point loading and line contact as well as under condition of pin on disc where the pin was a diamond indenter. The tests were carried out under reciprocating sliding condition with and without lubrication. Studies under unidirectional sliding condition were also taken up. Initial studies up to 250°C showed promising results. The sliding pairs used were bearing steel ball against the ceramic, and diamond against the ceramic. Co-efficient of friction 0.45 (unlubricated) fell drastically below 0.1 with the addition of a drop of water as lubricant. Silicon nitride developed at CGCRI showed negligible wear at a load of 20 Newton, sliding velocity 0.1 m/s and total travel distance 900 m. Composites made from boron nitride and titanium carbide were found to be inferior to the best silicon nitride based ceramics. Zirconia-based ceramics were inferior in their characteristics as compared to the corresponding non-oxide ceramics. The specific wear rates of typical ceramics under above load and sliding conditions were found to be: silicon nitride — negligible, sialon (x=0.5)—1.5×10^{-5} $mm^3/m/N$, silicon nitride-boron nitride composites — 4.05×10^{-5} $mm^3/m/N$, silicon nitride-



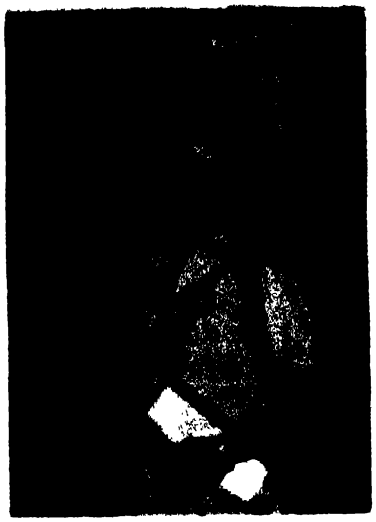
1. RPA payload electronics for SROSS C Satellite
2. NV Complex under construction at Faridabad
3. Japanese mint, MAS-1 (*Mentha arvensis*)
4. Sliding pair for friction and wear studies. Large discs on left and right are tetragonal zirconia under line contact and dense titanium nitride-alumina composite under Hartizan contact: upper and lower small discs are sialon and dense silicon nitride
5. Experimental set-up for characterization of high Tc RF SQUID
6 Wall tiles from fly ash

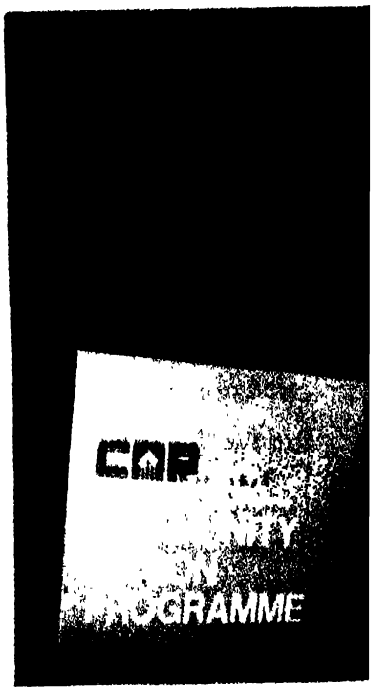






1. Membranes for reverse osmosis plants in Thailand
2. *Artemisia annua* L. — a valuable source of the antimalarial artemisinin
3. Shyma - a new variety of opium poppy evolved by CIMAP
4. NPL Scientists performing experiment at Maitree, Antarctica
5. Inside view of the mobile laboratory van for water quality analysis
6. Optical fibre telephone system at Malkera Colliery, Dhanbad
7. Community Action Programme kit designed by NEERI





titanium carbide — 1.7×10^{-5} $mm^3/m/N$. The load test showed that nitride based ceramics would be excellent material for bearing application at high load, high speed and high temperature. They can also withstand lubrication starvation.

Optical Fibre Telephone System installed at Malkera Colliery

CGCRI successfully produced doped high-silica glass preforms using the conventional MCVD process. Fibres of standard dimensions (50 µm core, 125 µm clad) with acrylate resin coating were prepared from these preforms. With the help of Hindustan Cables Ltd, about 9.1 km of optic fibre was jacketted with thixotropic jelly filling and cabled with polythene sheathing in duplex, 6-core and 8-core configurations. The ends of the cabled fibres varying in length from 70 to 1 15 km were connectorized in CGCRI, and tested for audio and video signal transmission. With the help of adapters and the 6-fibre and 8-fibre cable pairs, the links were extended to the pit top surface (374 ft above the 16 seam pit bottom) of Malkera Colliery, Dhanbad, for final connection to a manually operated switching exchange along with two additional surface links. For operating mode, all the points from bottom to the exchange and bottom to bottom were connected directly through manual switch at the surface exchange.

This 10-point optical communication system is the first analogue mine network developed indigenously. Three CSIR laboratories, viz. CGCRI, Central Scientific Instruments Organisation, Chandigarh, and Central Mining Research Station, Dhanbad collaborated in this project.

Production of Solvent Refined Coal

The steel plants in India try to limit the ash content in coal blends to 17±.5% by blending imported low ash coal as a sweetening agent in the coking blends, especially for the high capacity blast furnaces with stringent specifications in terms of coke strength and its reactivity. With a view to utilizing the indigenous coal resources rationally and reducing the dependence on the imported coking coals, the Central Fuel Research Institute (CFRI), Dhanbad, developed the SRC technology. Solvent Refined Coal (SRC) was obtained as a solid-pitch like product, by solvent extraction of non coking coal, oil agglomerated washery middlings and lignite following the slurry phase hydrogenation route in a 500 kg/day pilot plant under elevated temperature and pressure.

Investigations with 5-10% addition of SRC in conventional coal blends resulted in increased coking propensities with enhancement of fluidity, plastic property, coke type and coke strength besides reduction in ash content of the resultant coke. It may be possible in future to replace considerable amount of imported coking coal by the addition of 10% SRC having ash content of about 8%.

Bulk samples of SRC containing 7-8% ash produced from high ash Samla seam coal of Raniganj coalfield and similar high ash oil agglomerated washery middlings were produced by the CFRI technique. These bulk samples were supplied to and tested in the Research and Development Centre for Iron & Steel of SAIL, Ranchi and also in CFRI. The results were extremely encouraging.

'Kumbraj' Coke Oven for Production of Metallurgical Coke without using any Prime Coking Coal

The gross in-situ reserves of prime coaking coals available in India have been estimated at 5,300 million tonnes and that of medium coking coals 20,600 million tonnes. However, the consumption of prime coking coals in steel plants is more as compared to the medium coking coals. The Central Fuel Research Institute (CFRI), Dhanbad, developed a beehive coke oven, popularly called 'Kumbraj' to carbonize low volatile medium coking coals. Kumbraj is a fast coking, sole heated, recuperative oven which is almost pollution free. It consists of a battery of ten ovens connected to 80 ft high chimney. The battery of ovens has been provided with 70 control dampers which ensure controlled flow of preheated primary and secondary air at appropriate places to achieve optimum heating of oven. Actual coking tests carried out in the Kumbraj established that it is possible to produce strong metallurgical coke having a stabilized M_{10} index of less than 8 from an inferior low volatile medium coking coal having ash content of 32.5%, volatile matter content of 18.3%, caking and swelling indices of 14 and 1 respectively and maximum fluidity of only 15 ddpm. With top charging and without using any additive, no byproduct coke oven plant anywhere in the world at present can produce such strong coke from such an inferior coking coal. Also, the technology requires a low capital investment.

CFRI submitted in January 1990 a concrete proposal to the Chari Committee (expert committee appointed by the Government of India) for production of coke from washed low volatile medium coking coals and its trial in the large capacity blast furnace.

Electronic Systems for Pulp and Paper Industry

The Centre for Development of Electronic Systems (CDES) at the CEERI Madras Centre developed the following appropriate electronic systems for the pulp and paper industry: Locomon (Low consistency monitor), Moisture gauge,

GSM (grams per square metre) gauge, 'C' frame and 'O' frame instrumentation.

These systems have been thoroughly field tested and can be used in all kinds of paper mills, particularly the small paper mills. Also, they can be employed in mills using a variety of raw materials like bagasse, countrywood, straw and waste paper. The technology has been transferred to the following two entrepreneurs to start with: M/s Servall Engineering Industries Pvt. Ltd, Coimbatore and M/s SPA Computers Ltd, Bangalore.

Software for designing of Commercial Plants

The Computer-aided Design (CAD) Centre at the Indian Institute of Chemical Technology, Hyderabad, developed the following new software for the designing of commercial plants: *rnf* — This program has been developed for the design of reinforcement of openings in pressure vessels, as per the procedure given in ASME Section VIII, Division I. It can design for fifteen different types of nozzle attachments. *fxts* designs fixed tubesheets for a shell and tube heat exchanger as per the code of TEMA. *extpr* has been developed for the design of pressure vessels subjected to external pressure. It can design for fifteen different ferrous materials. *intpr* designs pressure vessels subjected to internal pressure. It also calculates the empty and water-filled weight of vessel, and can design vessels for sixteen different ferrous materials of construction. *prdrop* calculates the pressure drop in pipelines with single phase flow; fifteen types of fittings and components have been considered. *bsfrp* designs pressure vessels made of fibre reinforced plastics subjected to internal pressure.

Reverse Osmosis Membranes exported to Thailand

The Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, had earlier donated two reverse osmosis desalination plants, one stationary plant of 30,000 litres/day capacity and the other a mobile plant of 15,000 litres/day capacity, to the Government of Thailand, for converting brackish water into potable water. Based on the successful performance of these plants, the Thailand Government placed order with NRDC for the supply of 4000 sq.m of RO membranes, over a period of one year, at a total cost of $ 1,60,000. It is understood that the Thailand Government would install 20 RO desalination plants employing CSMCRI membranes at different places for supplying good quality potable water to the local community.

WHO undertakes Mass Production of CAP Kits

The World Health Organisation, Geneva, allocated $1,65,000 for the mass production of Community Action Programme (CAP) kits designed by the National Environmental Engineering Research Institute (NEERI), Nagpur. The assignment for the design of CAP kits was awarded to NEERI by WHO and UNEP (Nairobi). The kit provides information regarding preventive environmental measures for insect and rodent control in high density, low income urban areas. It aims at improvement of the basic conditions such as household hygiene, water supply, sanitation, wastewater removal, garbage disposal, and attitudes and customs of people.

The kit contains information on eight insect and rodent vectors, viz. mosquito, rat, louse, bedbug, cockroach, housefly, soundfly, and assain bug in the form of CAP guide, manual, intervention sheets, posters and games, and is designed for the use by community and health workers.

The mass production of the kit would be in official languages of United Nations. The material of the kit has already been translated in several Indian languages by voluntary agencies.

Aromatic & Medicinal Plants

Introduction, cultivation, production, processing and utilization of aromatic and medicinal plants forms one of the major activities of CSIR. The Central Institute of Medicinal and Aromatic Plants, Lucknow, has developed a large number of agrotechnologies for these plants, which are under utilization. Some of these are for: Japanese mint, Peppermint, Bergamot mint, Native Spearmint, Scotch Spearmint, Citronella Java, Palmarosa, Linaloe, Davana, French basil, Patchouli, Hops, Bulgarian coriander, Ergot, Belladona, Pyrethrum, *Ammi majus*, Periwinkle, *Eucalyptus citriodora*, *Rauwolfia serpentina*; Lemongrass, Lavender, *Duboisia myoporoides*, *Hyoscyamus muticus* and Opium poppy.

The R&D activities of the National Botanical Research Institute, Lucknow, include: Building up of the germplasm with wide genetic base, Improvement of ornamentals for national and international trade, Development of agrotechnologies suitable for introduced/acclimatized and improved material and Studies on post-harvest physiology, based on the multi-disciplinary approach. The plants which have been studied include chrysanthemum, gladiolus, bougainvillea, amaranthus, gerbera, canna and rose.

Artemisinin: In view of the usefulness of artemisinin and its derivatives in the treatment of malaria, CIMAP and CDRI launched a collaborative drug development programme. The programme included successful introduction of *Artemesia annua* plant in India and its large scale cultivation, pilot scale isolation of artemisinin, synthesis of potent lipophilic deriva-

tive Arteether and other derivatives, pre-clinical, antimalarial, pharmacological, toxicological, chronic toxicological and formulation studies. The Drugs' Controller of India has cleared arteether for clinical trials to be undertaken by CDRI.

Himalayan Hogweed — A Potential Source of Xanthotoxin

Xanthotoxin is used in the preparation of sun-tan lotions. It also possesses antileucodermal properties. As a result of chemical investigation of Himalayan species of the genus *Heracleum* L. (Hogweed) carried out at the Regional Research Laboratory (RRL), Jammu, one species, viz. *H. candicans* Wall was found to be a good source of xanthotoxin. For preservation of this species and also for making available assured supply of quality raw material, the RRL Branch laboratory at Srinagar successfully domesticated the herb and made a detailed study of its agrotechnology. In fact, the cultivated material was found to be superior.

Low cost Compost-making Unit for Button Mushrooms

A low cost compost-making unit was designed, fabricated and installed at CSIR Complex, Palampur. The model unit is in production now, providing quality compost material to local mushroom growers. The unit has a capacity to produce 60 tonnes compost per month which can meet the requirement of 18-20 small scale growers in the region. It is ideally suited for the hilly regions where transportation costs are relatively high and carriage of compost material from one place to other is detrimental to the growth of the mushroom industry. The unit requires a capital investment of about Rs 2.5 lakh only and can be installed by individuals or co-operative societies.

CSIR Programme on Global Change

There is a growing awareness, both at the international and national levels, of the necessity of preserving local regional and global ecological balance. On a global level, the International Council of Scientific Unions, United Nations Environmental Programme and the World Meteorological Organisation are the important organizations which, through their special committees, are trying to study and find solutions to the deteriorating world climate. On a national level, CSIR, Ministry of Environment & Forests, Department of Space, Indian National Science Academy and many other organizations have taken up climate change studies.

CSIR, with multidisciplinary character of its laboratories and its involvement with projects interfacing with those of International Geosphere Biosphere Programme, has a major role to play in studies on global change. Keeping this in view, CSIR has constituted a 'Steering Group for Global Change' to identify, plan and lay down milestones and monitor the progress of projects and activities in this area. The CSIR Programme on Global Change has been further subdivided into the following eight areas and a Task Force consisting of a number of CSIR laboratories has been formed for each of the areas: Chlorofluorocarbon substitutes and alternative technologies, Greenhouse gases and global warming, Sea level monitoring and modelling, Air Sea interactions, Medical effects and related aspects, UV-B and temperature effects on ecosystems, aquatic systems and industrial materials, Earth system history and Mathematical modelling for global change.

Considerable amount of work in these areas has already been done in CSIR laboratories. The Council brought out a publication: CSIR Programme on Global Change, giving a consolidated account of its achievements/activities in this area.

Caribbean Oceanographic Research Exploration (CORE) Project

CORE project is one of major international collaborative projects launched by CSIR and the Commonwealth Science Council, with a view to using the Indian capabilities in oceanographic research to help the Commonwealth countries in the Caribbean, through international scientific collaboration. The specific objects of the project are: To train scientists and engineers in the operation of marine survey equipment, sampling, data collection and interpretation of the data collected; To carry out a survey of resources in the Caribbean sea; and To create a computerized database of oceanic resources and environmental parameters of the Caribbean, which can be used as a platform for future oceanic activities.

The project was worked out by the National Institute of Oceanography, Goa, in joint collaboration with CSC and the Department of Ocean Development which owns ORV *Sagar Kanya*. The 13 Caribbean countries, via. Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Monsterrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, and two regional bodies - Caribbean community (CARICOM) and the organization of Eastern Caribbean states cooperated with CSC in developing the project, estimated to cost about one million dollars.

The first and second phases of the project consisted of assessing the needs of various Caribbean countries. It was done through visits of the delegations to Caribbean. During the third phase, 22 Caribbean scientists were given classroom training for about three months at NIO.

Fourth phase of the project consisted of giving practical training to the CORE participants in all aspects of oceanographic science and making an assessment of the living and non-living resources of the Caribbean Sea. The cruise (14 April - 24 May 1990) encompassed the EEZs of Belize, Bahamas, Antigua and Barbude, Monsterrat, St. Lucia, St. Vincent and the Grenadines, Grenada, Barbados, Trinidad and Tobago and Guyana.

During the cruise, about 45 stations were covered and the data on various oceanographic parameters such as temperature, salinity, pH, nutrients such as phosphates, silicates, nitrates, etc., primary productivity, secondary productivity/zooplankton biomass were collected. In addition, meteorological, geological and geophysical data were also collected. The data are being analyzed at NIO and the findings of the survey are being interpreted, which will be communicated to CSC and CARICOM. About 60 Caribbean scientists were benefitted from this project.

Indian Scientific Expeditions to Antarctica

CSIR has actively participated in all the Indian Scientific Expeditions to Antarctica where two permanent stations, viz. *Dakshin Gangotri* and *Maitree* have been set up by the Indian scientists. Studies have been made during these expeditions in the following areas: geophysics, meteorology, upper atmospheric physics, ozone depletion, oceanography, geomagnetism and radioactivity measurements.

Participation of CSIR Scientists in the First Indian Scientific Expedition to Weddel Sea: Two scientists of the National Geophysical Research Institute, Hyderabad, participated in the above expedition to Weddel Sea, Western Antarctica. The expedition team consisted of six scientists, three from GSI, one from ONGC, apart from the two CSIR scientists. During the expedition, the scientists carried out reconnaissance survey of the Filchner shelf and Berkner island. Unlike the east Antarctica, the west is more dangerous and access to Weddel Sea is limited to short periods during summer that too once in a few years.

National Technology Missions

Under the concept of Science and Society, the Government has adopted seven National Technology Missions on drinking water, oil seeds, immunization, literacy, telecommunications, wasteland development and dairy development as a major management innovation. These missions are intended to bring about a significant socio-economic transformation and a large number of organizations are involved in the implementation of these missions. CSIR is involved in four of these societal missions: drinking water, oilseeds, immunology and wasteland development.

CSIR has made valuable contributions to the drinking water mission. It has carried out geophysical surveys for water resources and has developed pumps for lifting water, tanks for storing water, and technologies/equipment for water purification. Techniques like slow sand filtration, reverse osmosis and electrodialysis have been adopted for water purification. Water analysis/monitoring surveys have been carried out at a large number of places. Recent contributions in the field include the development of water analysis kits, mobile van for carrying out water analysis and Bact-o-kill — a device for water purification.

The demonstration plant for extraction of edible grade raw palm oil, set up on turnkey basis at Palode (Trivandrum) as a part of the National Collaborative Programme for Oilseeds between CSIR and ICAR and inaugurated in January 1989, was operated at optimum efficiency. The quality of oil and operational efficiency were found to be comparable with the international standards. On the basis of this achievement, the concerned CSIR laboratory - Regional Research Laboratory, Trivandrum - has been asked to prepare a full engineering package for setting up two extraction units of 10 tonnes/day capacity in Andhra Pradesh, with funding under the technology mission on oilseeds.

Memorandum of Understanding between CFTRI and US Wheat Associates

Under a memorandum of understanding between the Central Food Technological Research Institute (CFTRI), Mysore, and the US Wheat Associates, an organization of the American wheat farmers, a short-term research programme on suitability of soft white wheat for Indian style wheat-based culinary and confectionary products, was launched at the International School of Milling Technology (ISMT), CFTRI. Under the programme, the ISMT scientists assessed the likely usage of whole wheat meal (*atta*) and flour (*maida*) produced from US soft wheat for Indian traditional products (bread, chapatis, buns, parothas, pooris, etc.) and confectionary products (cakes, cookies, Danish pasteries etc.) The research programme covered a study of milling, chemical, rheological, sensory and test

baking characteristics of both US and Indian wheat flours. The products prepared were subjected to large scale evaluation and consumer acceptance studies at CFTRI and local bakeries.

NEERI signs MoU with NPC for undertaking EIA Studies of Atomic Power Projects in India

The National Environmental Engineering Research Institute (NEERI), Nagpur, signed a memorandum of understanding with the Nuclear Power Corporation (NPC) for undertaking Environmental Impact Assessment (EIA) studies of the atomic power projects in India. These studies would result in the preparation of scientific environmental management plans ensuring compatability between environment and economics related to the atomic power plants.

The R&D work on EIA involves collection of baseline environmental status, identification of potential adverse impacts, prediction of significant impacts with recourse to mathematical and simulation modelling, and evaluation of quantified impacts as a basis for preparation of environmental management plans.

Risk Assessment of IPCL Plants

The Central Leather Research Institute (CLRI), Madras, received a work order from the Indian Petrochemicals Ltd (IPCL) to study the potential hazards (including run-away reactions) and risks arising from materials, processed, stored or handled, at the sites of: (i) Bicomponent Acrylic Fibre Plant, (ii) Polypropylene Copolymer Plant, (iii) Gas Turbine Power Plant and (iv) Aromatics Expansion Plant at IPCL's Baroda complex.

The Cell for Industrial Safety and Risk Analysis (CISRA) at CLRI, is the coordinating agency for this assignment. The Safety Group of the Chemical Engineering Division, Indian Institute of Chemical Technology, Hyderabad, is also participating in the investigations. Specialized services from the Netherlands Organization for Applied Research (TNO), in the fields of computerized information on the past chemical accidents and event probability analysis will be availed

CISRA has already executed, during 1989-90, the hazard analysis of the new refinery to be set up by MRL at Cauvery Basin, aromatic complex to be set up by NAPCO at Manali, Madras and Chlor- Alkali plant of the Andhra Sugars, Kovvur. Also CLRI, NEERI, ITRC and TNO have jointly investigated the risk potential of Hazira Gas Processing Complex of ONGC during 1989-90.

The IPCL assignment involves Maximum Credible Accident and Consequence (MCAC) analysis, effect and damage calculations, limited HAZOP and FTA and probability study of group events. Foreign exchange saving to the tune of Rs 1.2 million is anticipated from this assignment.

Conferences/Symposia/ Seminars/Get-togethers

Some of the important conferences/seminars/get-together held during the last year were: Fifth International Symposium on Acoustic Remote Sensing of the Atmosphere and Oceans (NPL, New Delhi); International Symposium on Land Subsidence (CMRS, Dhanbad); Fourth International Symposium on Frontiers of Electrochemistry (CECRI, Karaikudi, held in Madras); International Conference on Luminescence (CECRI, Karaikudi); Indo-British Workshops on Heat Pumps and Energy Conservation (NCL, Pune - held in New Delhi and Pune); CSIR-KVIC Workshop on Selected Food Processing Technologies of CFTRI (CFTRI, Mysore); Symposium on Coal Utilization: Trends & Challenges (CFRI, Dhanbad); National Seminar on Bio-Ceramics (CGCRI, Calcutta); National Conference on Prospects for Transfer of Technology from Indigenous Sources to Indian Industry (CSIR-FICCI, New Delhi); Workshop on Procurement Procedures' of World Bank (CRRI, New Delhi); Second Annual Business Meeting on Technology Transfer and Marketing of CSIR Knowledgebase (NCL, Pune); Symposium on Nutrition and Drug Action (CDRI, Lucknow); 35th Tanners Get-together: Perspectives, Policies and Plans for Leather Industry in Nineties - A consensus (CLRI, Madras); Workshop on Futurology (RRL, Jammu); First National Congress on Metallic Corrosion (CECRI, Karaikudi); National Seminar on Scope of Essential Oil Industry in U.P. (CIMAP, Lucknow); Workshop on Clinical Pharmacokinetics (CDRI, Lucknow); Seminar on Technology Upgradation in Drug Industry (PTC, Hyderabad); Seminar on New Entrepreneurial Opportunities in FRP Products (CGCRI, Calcutta); and NRDC Training Programme on Management of Technology Transfer, Patents and Information Systems (RRL-Trivandrum).

A unique event of the year was the holding of Bhatnagar Laureates' Get-together, in which 154 of the 227 Bhatnagar laureates who had won the award till date, participated. The Bhatnagar laureates used the occasion to exchange their views which could help in the furtherance of excellence in S&T. In addition, some 15 laureates delivered invited lectures not only on the present and future of S&T in India but also on their own fields of research.

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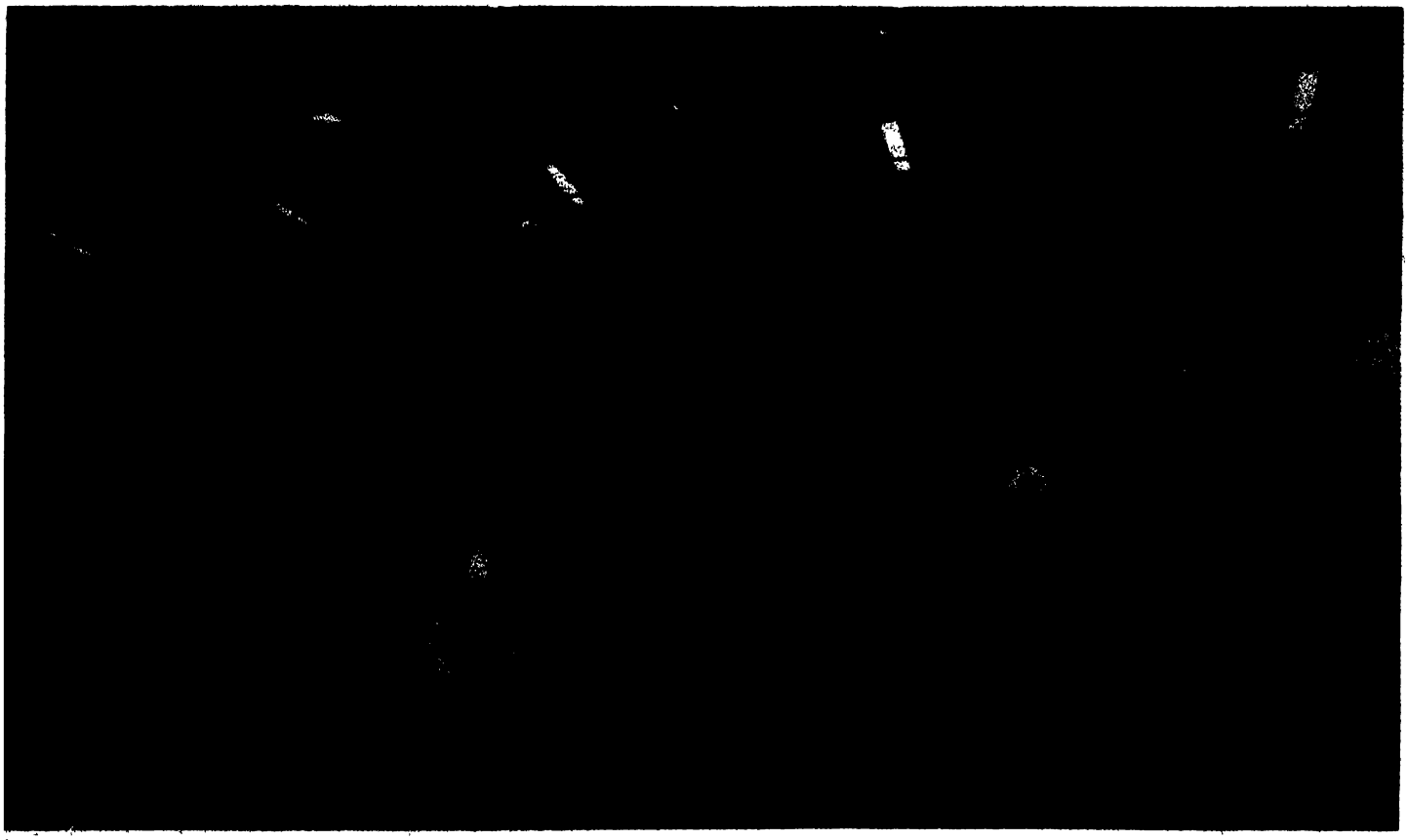

Ground vibration testing of the HS 748 aircraft with pylon at NAL, Bangalore. A report on the laboratory's R&D activities during 1989-90 appears on p. 209

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CGCRI developes Ceramic Hip Joint Prosthesis for Bio-Medical Implants

Total partial hip replacement (arthroplasty/hemi-arthroplasty) is one of the most common orthopaedic operations. It is performed to relieve sufferings experienced by patients with degenerative disease affecting the hip-joint. This condition is commonly referred to as osteoarthritis or osteoarthrosis and is more prevalent in women particularly those in the 60 plus age group. It can also be present in young people who may have some underlying pathology affecting the hip joint.

Studies on the development of these bio-medical implants have been continuing in advanced countries for the last one decade or so and many types of prosthesis for total hemi/hip replacement have been designed over the years. The implant materials, so far developed could be classified into three groups:

(i) *Bio-tolerant:* PMMA cement and stainless steel are the two examples. There is always an interface conversion film of connective tissue between the bone and cement or steel implant.

(ii) *Bio-inert:* e.g. ceramics — they allow direct bone contact.

(iii) Bio-active: Hydroxy appetite entices new bone across the implant/bone interface. Various terms are being used for this, e.g. osteo integration.

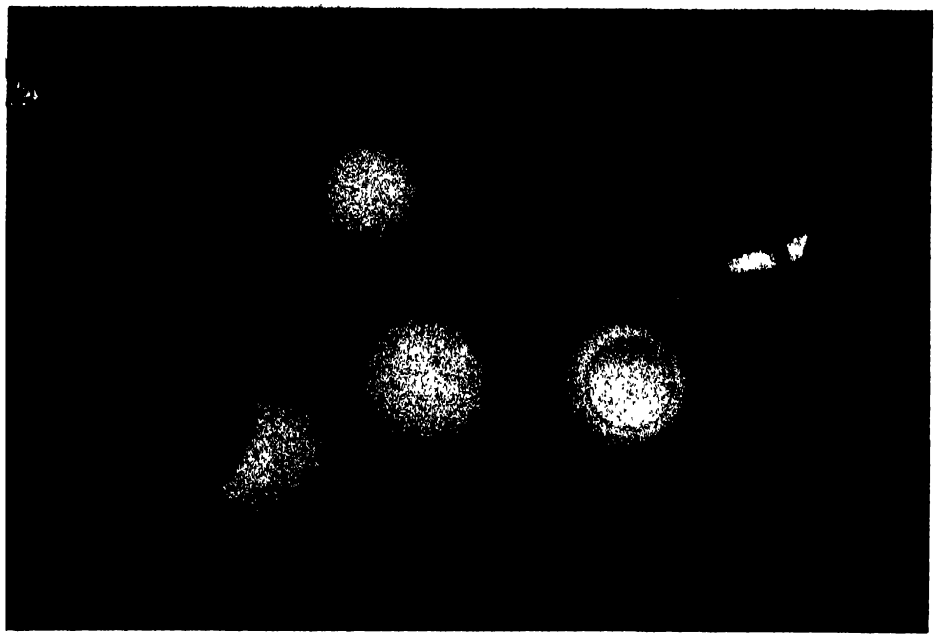
The Technical Ceramic Group of the Central Glass & Ceramic Research Institute (CGCRI), Calcutta, has successfully developed hip joint prosthesis with ceramic heads, in collaboration with the Calcutta Medical Research Institute, Calcutta. Two young scientists: Shri Debobrato Basu and Shri Sandip Chatterjee of the institute were responsible for this unique success, who worked initially under the guidance of Dr S.K. Guha (now retired) and later on under Shri M.K. Basu, Project Coordinator. These heads are made of high purity alumina and fit with the modified 'Austin Moore standard stainless steel stem for implantation in human body as hip-joint (hemi-arthroplasty) replacement; first set of such prosthesis has been implanted in a 62 year old lady at the Calcutta Medical Research Institute. This implantation of ceramic head as hip joint prosthesis is the first of its kind in India. Subsequently two more similar operations have been carried out on two more female patients recently at the Calcutta Medical Research Institute and the post operative studies on the patients have shown that the transplantations are highly satisfactory and no abnormal effects have been observed in the patients so far.

The material used for developing the implants was basically high purity alumina (purity level being 99.7%). Alumina powder of this variety was pressed isostatically to prepare blocks which were subsequently turned into the shape of threaded spherical balls. After sintering, these heads were mechanically polished to C.L.A. 0.02 μm. The heads were specially designed to have reduced bulk density to match with that of bone samples of heads. These heads were evaluated for toxicological characteristics at the Bengal Immunity Research Institute, Calcutta and reported to be fully biocompatible and non-toxic.

The heads so formed were hydrothermally treated to reduce the bacteria count. Suitably modified Austin Moore type of standard stems were made through external sources and both the heads and stems were gamma sterilized at ISOMED, Bombay, prior to implantation.

Until recently, even in the most advanced countries this prosthesis was held in position by a cement like material known as methyl methacrylate. But the high failure rate of cement in the younger, more active patients and difficulty encountered in the resetting/replacement of the heads has led scientists to seek better methods of fixation than the cemented designs of hip arthroplasty/hemi-arthroplasty. Therefore, in the present case threaded uncemented prosthesis

X-ray photograph of ceramic hip joint prosthesis after transplantation in a 62 year old lady



Ceramic heads and metallic stems of the prosthesis developed by CGCRI, Calcutta

are designed to preserve the anatomical dynamics of the hip joint using proximal load transfer.

The bio-inert material is being hailed by orthopaedic specialists as the new wonder implant material. In total hip joints the wear rate of ceramic/ceramic is said to be 1/300 of metal plastic and that of ceramic plastic 1/100 of the wear rate of metal/plastic. Therefore, it is expected that such prosthesis will have much longer life and direct implantation will eliminate otherwise complicated cup transplantation and use of bone cement which is believed to create certain problems with passage of time. With the advent of this cheap variety and superior grade of prosthesis material, it is hoped that numerous patients of this country would be able to return to a high quality normal life style with maintenance free service of these implants. In continuation of the above work the institute plans to direct its future research activities towards developing other joints like wrist, elbow, shoulder, knee.

Vesicular-Arbuscular Mycorrhiza (VAM) Cultured on Synthetic Medium

Symbiotic associations between fungi and plants are called mycorrhizae. The most significant effect of mycorrhizae is their ability to enhance plant growth and biomass production. Some mycorrhizal fungi that penetrate roots and form specialized structures, such as vesicles and arbuscules within the cortex are called vesicular-arbuscular mycorrhizae (VAM). Almost 90% of plants including the most important agricultural crops are known to be associated with VAM-fungi. VA-mycorrhizae increase the absorption of nutrients such as phosphorus, copper and zinc by the plants. Increased uptake of phosphorus is often correlated with enhanced growth and biomass production. They have also been found to enhance drought resistance and resistance against certain root infecting pathogens.

VAM-fungi are considered to be obligate symbionts. However, they have not, so far, been grown on any artificial medium, and are usually maintained and multiplied in pot culture. The inability to grow VAM-fungi in culture has been the major difficulty in their application and commercial use in agriculture. Experiments carried out at the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, have for the first time led to the isolation and culture of a VAM-fungus on a synthetic medium.

Glomus aggregatum Schenck & Smith, a VAM-fungus, associated with palmarosa (*Cymbopogon martinii* var. motia), was isolated and grown on White's medium supplemented with yeast extract. The isolation of the fungus was accomplished by two-step method from infected root segments. The VAM isolate was multiplied and maintained on White's medium supplemented with yeast extract. Microscopic examination showed aseptate, branched, hyaline mycelium. The fungus also produced globose or spherical double walled chlamydospore-like structures in the culture.

VAM-nature of the isolate was confirmed by inoculating the fungus on to callus cultures, axenic plants and potted plants of palmarosa. The VAM-isolate produced typical spores and mycelial coils/aggregation in the roots of inoculated axenic plants. The fungus also produced abundant spores, vesicles and arbuscules/mycelial coils within the roots of infected potted plants. Morphology of spores produced by the VAM-isolate within the roots and soil was identical to *G. aggregatum*.

Characteristic feature of VAM association in plants is the enhanced growth and phosphorus uptake. Palmarosa plants inoculated with the VAM-culture showed 2-3 times higher growth and 3-4 times greater biomass production as compared to controls. Analysis

of the inoculated plants also showed significant increase in phosphorus content, thereby indicating enhanced phosphorus uptake.

The experimental results thus indicate that the fungus isolated from the roots of palmarosa and cultured on the synthetic medium is a true VAM-fungus. This is the first report of the culture of a VAM-fungus on a synthetic medium. The finding thus reveals that VAM-fungi which are considered as obligate symbionts can be cultured on synthetic medium. The discovery is a major break- through in mycorrhizal research.

In the ongoing food monitoring programme, 681 samples of powdered red chillies and 686 samples of turmeric collected from both rural and city markets of all 57 districts of U.P. were screened. For analysis, a newly developed solvent system was employed, which offers quick separation on plain non-coated paper strips. Red chilly powder samples showed 20% adulteration while those of turmeric powder, 3.6%. All adulterated chilly samples were artificially coloured with fat soluble non-prescribed dyes such as Sudan I, Sudan II and Sudan III/IV which are known to be highly toxic. Turmeric samples contained the two popular prohibited dyes, metanil yellow and orange.

Effluent Treatment Plant commissioned at Rourkela Steel Plant

A pilot plant for the treatment of effluent waters of the coke oven batteries has been set up at the Rourkela Steel Plant. The plant is based on the ion exchange technique developed by the Regional Research Laboratory, Bhubaneswar, in collaboration with the Research and Development Centre for Iron and Steel, Ranchi. The plant, commissioned on 24 July 1990, removes phenols and cyanides from the effluent waters to the tolerable limits by using continuous fluidized bed ion exchange technique. The work was taken up as a CSIR-SAIL collaborative project with SAIL R&DC, Ranchi.

The plant has a capacity to treat 1000 litres of effluent per hour. It has three columns: extraction column, elution column and wash column, each of 380 mm diameter and 2500 mm length. Other details of plant are:

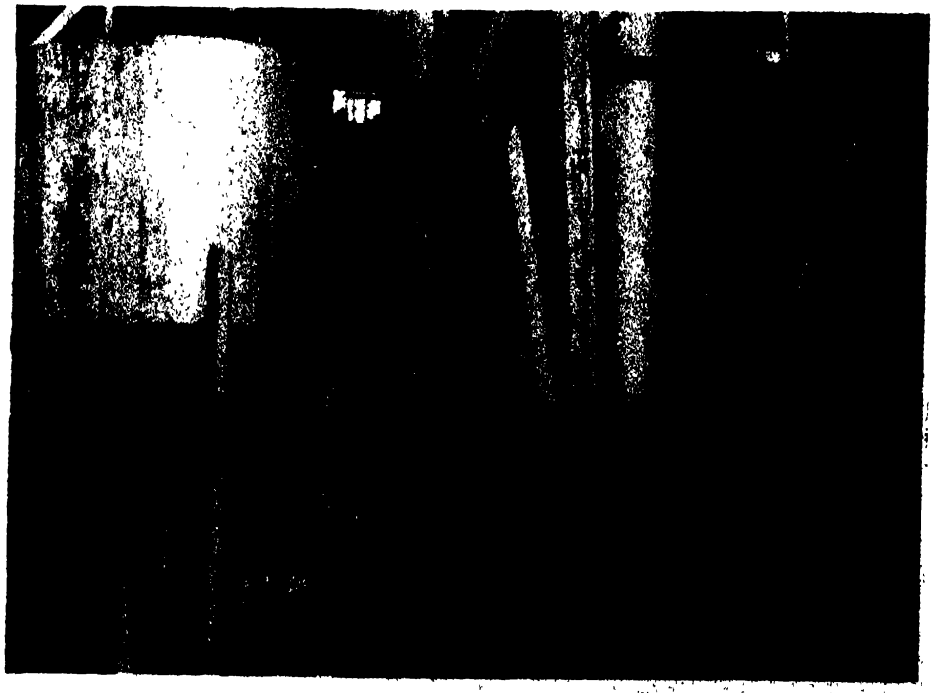
Crude effluent storage pit :	30,000 litres
Tar and oil removal system :	1500 litres/batch
Tar and oil free effluent storage pit:	8000 litres
Filter press:	1000 litres/h of effluent

Effluent Composition

	Feed	On treatment
Phenol:	50-450ppm	0.5-50 ppm
Cyanide:	2-30 ppm	0.1-0.2 ppm
Tar and oil :	70-100 ppm	0-2 ppm
*p*H:	7-9	7-8

Process for Gold Recovery from Scraps

A simple chemical stripping process has been developed by the Madras Unit of Central Electrochemical Research Institute to recover gold from PCB scrap. PCB is a copper clad laminate (phenolic, epoxy, polyester, etc.) with gold plated on contact areas to provide low contact resistance and adequate wear resistance. Nickel is the undercoat for gold to serve as a barrier to copper migration. A need to recover gold arises if the plating is defective. The process involves stripping of the metals - copper, nickel and gold - in a suitable solvent and then selectively precipitating gold from the solution by the addition of a few chemicals. After the gold is separated, the solution is filtered off, the gold mud washed well and dried. The gold thus obtained is 99% pure and can be converted to gold salt for reuse in plating or for jewellery. The process can be appropriately extended to a variety of gold bearing scraps. The process has been released to the following three firms in Madras, at a



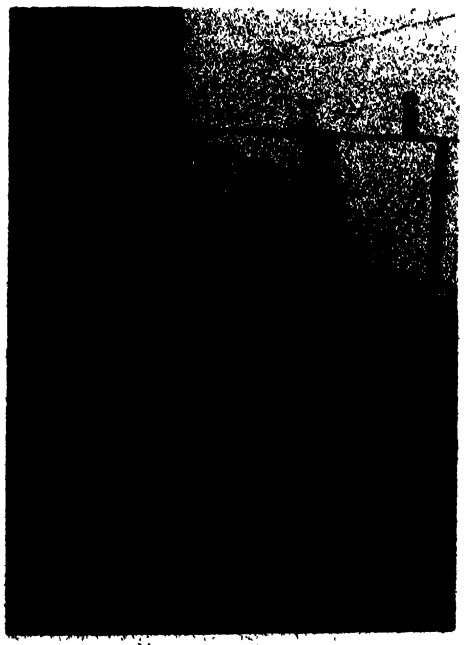
Effluent treatment pilot plant (capacity 1000 l/h) commissioned at Rourkela Steel Plant, Rourkela

lumpsum fee of Rs 10,000: Rangam Electronics Ltd, Fortran Cirkit Electronics Pvt. Ltd. and Himagiri Exim Co.

Test Rig for Knapsack Sprayer

Knapsack sprayers are used for spraying pesticides in fields. Quite a few parties are manufacturing these sprayers but not all of them adhere to the specifications prescribed by the Bureau of Indian Standards (BIS). MERADO, Madras, has developed at the instance of BIS, a test rig for carrying out pump performance and endurance tests on these sprayers (piston type).

The knapsack sprayer which is to be tested is rigidly mounted on the test bench. The handle of the sprayer is connected to an adjustable crank mechanism operated by motor through a reduction gear box. One end of a hose is connected to the discharge outlet of the sprayer and the other end to the inlet end of a straight rigid tube. A pressure regulator is fitted at the outlet end of the rigid tube and a pressure gauge is fitted in the tube. An extension tube is fitted at the outlet end of the pressure regulator for collecting the discharged water. The crank mechanism is adjusted so as to utilize the full stroke of the sprayer and the sprayer tank is filled up to its specified capacity with water. The pressure regulator is adjusted to develop a minimum pressure of 200 kPa. The discharge of water in one minute is collected and the exercise is repeated four times. The performance of the sprayer is found on the basis of the average discharge of water. In addition, a 40h endurance test is also carried out on this test rig, to certify a sprayer as per clause 5.1.3 of IS: 10134.



Test rig for knapsack sprayer developed by MERADO, Madras

ICMA Awards for NCL

It is for the first time in the history of ICMA that two of the Association's awards for the indigenous development of technology have been won by a single institution in the same year and the National Chemical Laboratory (NCL), Pune, has won this distinction. The two awards won by the institute are for its contributions made towards the development of technologies for manufacturing ethylbenzene and vitamin B_6.

ICMA Award for Novel and Complex Technology having widespread impact on chemical industry and economy, for 1989 has been won by the Hindustan Polymers, Visakhapatnam, for its unique achievement in commercializing the production of ethylbenzene using one-step non-conventional alkylation process in presence of specially structured zeolite catalyst developed by NCL. In recognition of NCL's valuable contribution in developing environmentally cleaner one-step process for manufacturing ethyl benzene, NCL will receive a special citation.

ICMA Acharya P.C. Ray Award for Development of Technology Indigenously, for 1989, has been won by the Lupin Laboratories Ltd, Bombay, for its outstanding contribution in the development of technology for the commercial production of vitamin B_6, involving complex eight-step organic synthesis. Simultaneously, NCL will receive a special citation for pioneering the challenging task of synthesizing vitamin B_6 and collaborating with Lupin Laboratories Ltd, Bombay, in the transfer of this technology successfully for commercial production.

Construction of a Low-cost Demonstration Rural House and Training Programme at Modhopar Village, M.P.

A lowcost demonstration rural house has been constructed at Modhopar village, Hoshangabad, M.P., with a view to imparting training to the local artisans, in the field of lowcost construction technologies. The programme was carried out by the Central Building Research Institute (CBRI), Roorkee, Regional Research Laboratory (RRL), Bhopal and PTC-Bhopal, incorporating latest CBRI and RRL (Bhopal) technologies on sun-dried mud blocks from inferior

soil (blackcotton), non erodable mud plaster, sisal fibre reinforced corrugated roofing sheets, fibre red mud polymer door panels, lowcost sanitation and wastewater drainage system and precast pedastal concrete piles for foundations. The construction was done with the involvement of local artisans, masons and villagers including women. The total cost of demonstration unit (prevailing market rates) worked out to Rs 8000. The house was inaugurated by Shri Suresh Sartaj Singh, M.P., in the presence of Shri Suresh Jain, Collector, Hoshangabad, and Dr T.C. Rao, Director, RRL-Bhopal and government officials from RES, CPWD, PWD, MPCOST, CBRI, RRL, and journalists.

The team of skilled persons trained in these technologies will facilitate further promotion and adoption of these technologies by the villagers.

Four more programmes of demonstration houses cum training in the districts of Gwalior, Raisen, Jabalpur, Bilaspur are being organized in collaboration with the Rural Engineering Service Bhopal, CBRI, MPCST and PTC.

CGCRI-BHEL Workshop on Ceramics

A one-day Workshop on Ceramics was arranged jointly by the Central Glass & Ceramic Research Institute (CGCRI), Calcutta and BHEL, Hyderabad, on 1 June 1990, with a view to identifying the projects needing collaborative efforts towards meeting the demands of ceramic materials and industrial self-reliance.

The CGCRI group led by the institute's Director, Dr B.K. Sarkar, who presented an account of the process know-hows, expertise and areas of strength of CGCRI with particular reference to the needs of BHEL in its efforts to indigenize production, improve processes and introduce product diversification.

The BHEL group led by Dr K. Ramakrishnan, Director (ERD), presented the problems faced by the different units of BHEL in terms of materials need, R&D gaps, indigenization and product diversification.

The discussions sharply focussed and identified a total of 15 projects for joint collaboration, classified into 3 categories - (1) Immediate transfer of technologies from CGCRI to BHEL (3 projects); (2) Short term (1 year) development projects (4), and (3) Long term (3 years) development projects (8).

Two task forces, one each from CGCRI and BHEL were formed to take follow up action. It was appreciated by both the sides that the strength and resources available at a premier institution like CGCRI can be tapped by another premier public sector undertaking like BHEL, to further the development and indigenization of advanced ceramic products for the overall benefit of the country.

Seminar on R&D Perspectives in Oils & Fats

The Indian Institute of Chemical Technology (IICT), Hyderabad, and the Oil Technologists' Association of India, Southern Zone jointly organized a one day seminar on R&D Perspectives in Oils & Fats on 30 May 1990 at IICT, Hyderabad. This seminar was organized in honour of Dr G. Lakshminarayana, Past President of OTAI and Deputy Director and Head of Oils and Fats Division, IICT, Hyderabad on the eve of his retirement.

The inaugural function was presided over by Dr S. Varadarajan, Chairman, Consultancy Development Centre, DSIR, Ministry of Science and Technology, New Delhi. Dr A.V. Rama Rao, Director, IICT, Hyderabad, gave the welcome address. Dr M.M. Paulose, President, OTAI, Southern Zone and Dr R. Subbarao, Convener of the seminar felicitated Dr G. Lakshminarayana. Prof. M.M. Chakrabarty, Adviser, UGC Centre of Advanced Studies, Calcutta University, Calcutta delivered the inaugural address. A memento was presented to Dr G. Lakshminarayana by OTAI, Southern Zone. Dr G. Lakshminarayana addressed the gathering giving his reminiscences. Shri K.V.S.A. Rao, Secretary, OTAI, Southern Zone, proposed a vote of thanks.

There were three technical sessions chaired by Prof. M.M. Chakrabarty, Dr K.T. Achaya and Shri K.V. Mariwala. The following ten invited lectures were delivered in the technical sessions: Biologically active lipids (Dr A.V. Rama Rao, Director, IICT, Hyderabad); Oil extraction and refining (Shri S.C. Singhal, American Soybean Association, New Delhi); Edible rice bran oil (Dr A.B. Afzalpurkar, IICT, Hyderabad); New techniques for vegetable oil processing (Dr B.L. Satyanarayana, Alfa Laval India Ltd, Pune); Biotechnology in processing oils and fats (Prof. D.K. Bhattacharyya, Calcutta University, Calcutta); Lipids in health and disease (Dr U.N. Das, The Nizam's Institute of Medical Sciences, Hyderabad); Upgradation of oilseed proteins (Dr K.T. Achaya, Bangalore); New hydrogenation catalysts for fat-based products (Dr R. Sreerama Murthy, Hindustan Lever Research Centre, Bombay); Lubricants and additives (Dr G.C. Joshi, Indian Institute of Petroleum, Dehra Dun); Oleochemicals (Shri K.V. Mariwala, The Bombay Oil Industries, Ltd, Bombay).

The seminar concluded with a vote of thanks by Dr R. Subbarao.

NAL Annual Report: 1989-90

The National Aeronautical Laboratory (NAL), Bangalore, pursues its R&D work in the following seven major divisions: Computational and Theoretical Fluid Dynamics, Experimental Aerodynamics, Materials Science, Propulsion, Structural Sciences, and Systems Engineering. The significant activities/achievements of the laboratory during 1989-90, reported in its annual report, are highlighted here:

A major contribution was made to the LCA programme by designing and fabricating a 1:4.405 scale high speed air intake model for testing in the wind tunnel at Modane, France. The model was completed and handed over to the Aeronautical Development Agency within the stipulated time of 10 months.

The construction of a new Advanced Composite Structures Laboratory was completed. The laboratory has an advanced ultrasonic 'C' scan inspection facility, a water jet cutter with computer control, and a material testing system. A 10,000 class clean room facility for lay up work has also been provided. A new computer controlled autoclave, bigger than the existing autoclave, would be located in the new laboratory. The new water jet cutting machine was extensively used in the fabrication of the CFRP box structure for ADA to conduct lightning tests. A GFRP bridge deck plate was successfully developed for R&D Engineers, Pune, using totally indigenous materials and state-of-the-art fabrication techniques involving soft tools. Also fabricated was a CFRP co-cured rudder for the Do 228 aircraft. A similar rudder fabricated at DLR, jointly with DLR scientists, was strength tested and found to withstand the design ultimate loads. The Structural Sciences Division took up the responsibility to fabricate, to the specified standards, CFRP rudders for LCA prototypes and deliver these to ADA at a cost of nearly Rs 20 millions.

NAL was actively involved in GTRE-sponsored R&D programmes aimed at providing inputs to the development of the indigenous gas turbine engine *Kaveri* at GTRE, which is expected to be used to power the LCA. A Memorandum of Understanding between GTRE and NAL, covering these projects and R&D support from NAL in general, was signed in October 1989. NAL's R&D programmes have already provided some inputs to the design of the high pressure turbine blade profile.

A geothermal power plant, designed and built at NAL, was set up at Manikaran, Himachal Pradesh, in August 1989, to generate electric power from hot water (about 90°C) issuing from borewells drilled in a water dominated geothermal reservoir. This 5 kW plant was indigenously developed under a collaborative programme between NAL, Geological Survey of India and the Himachal Pradesh State Electricity Board, with DNES sponsorship. The power plant was successfully commissioned and run at full load. It will meet the street lighting requirements of Manikaran village.

An improved version of the Flosolver parallel computer, with 16 80386-80387 processors, became operational during the year, marking a significant advance in NAL's parallel computer development programme. The new version attains a sustained speed of 3-4 MFLOPS. A panel code and a monsoon code, requiring a very intense computing environment, have been successfully run on the new Flosolver version.

The Civil Aviation Unit, set up in 1988 as part of NAL's growing involvement in civil aviation, undertook detailed design studies on the twin seater *ab-initio* trainer aircraft and the 8-10 seater light transport aircraft (LTA). The design configuration was examined for the power effects on trim, since

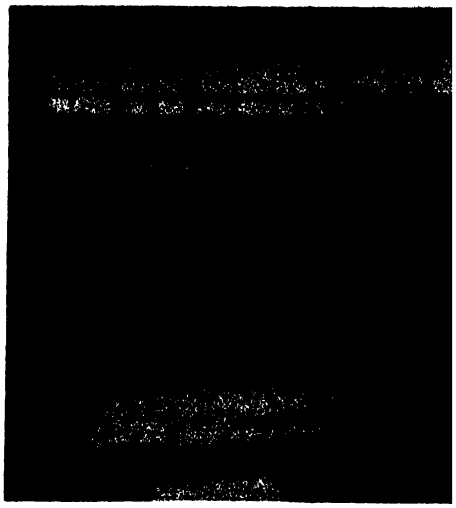
The geothermal power plant designed and built at NAL, Bangalore and set up at Manikaran, Himachal Pradesh. The plant generates electrical power from hot springs to meet the lighting requirements of Manikaran village

a pusher configuration was adopted to obtain undisturbed laminar flow over the specially designed wing sections. Efforts were being made to fabricate a wind tunnel model of the aircraft configuration for testing in the low speed wind tunnel. Preliminary structural design studies on the composite wing and the tail boom were carried out. The configuration of the 8-10 seater light transport aircraft, as defined in the preliminary study made last year, underwent significant changes as a result of work carried out.

Estimates were made of the impact of drag reduction, obtained by different extents of laminar flow on the wing and fuselage sections, on cruise efficiency (defined in terms of distance travelled per power of travel used). It was found that 8-12% increase in cruise efficiency can be realized with laminar flow over 30% of the fuselage and 50% of the wing. The estimated cruise efficiency of the LTA compares well with contemporary aircraft such as Starship, Piper, Cessna and Avanti.

The use of Al-Li alloys was proposed for the wing, as against carbon fibre reinforced plastics (CFRP), in view of the problems in certification. The empennage and other control surfaces would however, be made of CFRP/GFRP. The use of natural laminar flow design technology (coupled with winglets to reduce drag), efficient high lift devices (to enable operation from short air fields) and the application of composite and Al-Li alloy structures technology (to reduce weight) are the main features which make NAL's proposed aircraft attractive and competitive in terms of operating costs, and suitability to operate in Indian atmospheric conditions.

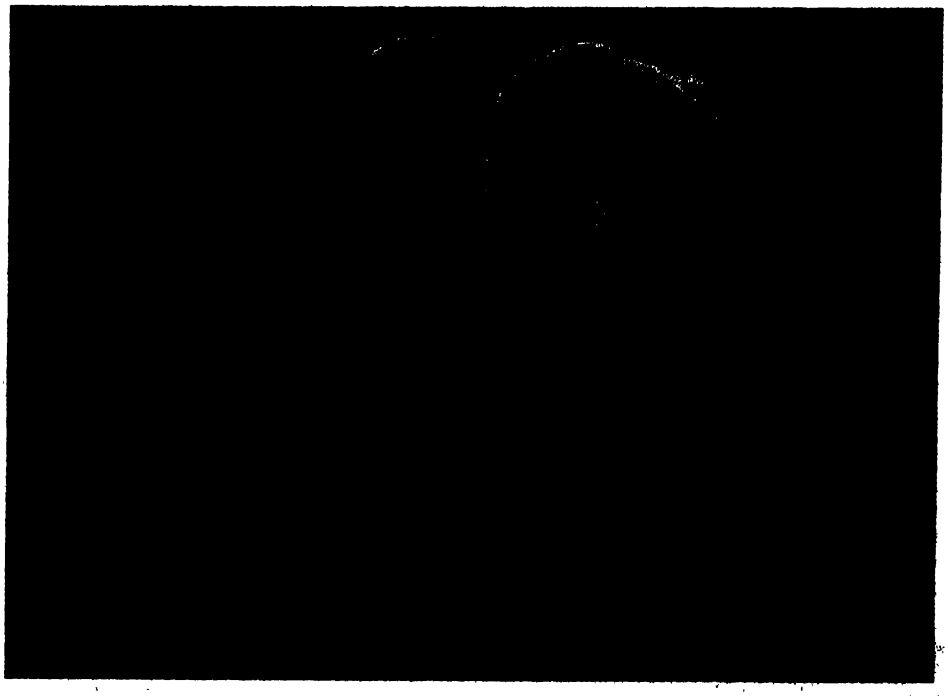
The Computational and Theoretical Fluid Dynamics Division, also formed in 1988, carried out interesting flow computations on the LCA wing using an Euler flow software package, at high angles of attack and at Mach numbers around 0.9, to study the vortex behaviour of the lee side of the wing. The non-linear vortex lift and vortex break down were predicted. The Division also produced designs of thick natural laminar flow airfoils, with an improved L/D ratio, for application to NAL's trainer and light transport aircraft.



Water jet cutter at the new composite facility

The Experimental Aerodynamics Division operated the 1.2m wind tunnel very efficiently, achieving more than 1000 blowdowns. This was possible with the simultaneous use of the diesel engine driven compressor system installed last year. Investigations were carried out on a combat aircraft configuration to study the effects of leading and trailing edge devices, and lateral and directional control devices, on the longitudinal and lateral characteristics at several free stream Mach numbers and side slip angles. Studies were carried out to obtain an appreciation of the effect of varying the gap, between the body and the air intake, on the overall aerodynamic characteristics. The effectiveness of fins and the location of gas tanks of the thrust vector control system on the control and stability characteristics of ASLV was studied. The strap-on booster trajectories of the PSLV were studied again for the initial separation of the two straps on booster as against the simultaneous separation of four boosters studied earlier.

The Division developed an effective method of estimating sting corrections on afterbody drag at transonic speeds, using correlation



Instrumented view of left hand and right hand panels of the Prithvi wing model

of base drag reduction with various parameters involving the geometry of the string and the afterbody obtained from extensive experimental data generated in the 0.3 m tunnel.

Experimental investigations were carried out on a typical missile model, incorporating the advanced technology concept of an integral launch rocket. The drag characteristics were studied in particular for intake entry and dump closed conditions and for different sizes of the gap betwen the body and the intake.

The studies on vortical flows on delta wings and bodies at high angles of attack were continued. Apart from wind tunnel testing of various LCA configurations, the Division also designed a 1/15 scale flow through model and also partially participated in its fabrication. Flow visualization studies were carried out on a typical combat aircraft model in the 0.3m x 0.3m water tunnel covering both high angles of attack and side slip. The coloured dye technique was used in these studies. The new 0.6 m tunnel also went through several blowdowns, primarily to calibrate the test section flow. Further improvements were made to the database management system for aircraft configuration to achieve greater scope in its use.

The technology for NALAR fibres, developed by the Materials Science Division, was transferred to M/s DCM. The package includes the basic process details, quality control procedures and recommendations for scale up. The Division also trained DCM personnel. The transfer of technology of fibre spinning was in progress.

The Division successfully made trapezoidal aluminium mirrors to be used as sunshield panels to serve as passive radiative cooler of VHRR (very high resolution radiometer) of INSAT II. The mirrors have passed all qualification tests, such as the thermovac test, the humidity test and the vibration test. These mirrors would have cost Rs 20 million in foreign exchange if they had been imported. The NAL-developed black chromium coating found application on a large scale during the year. HAL set up a large scale solar water heating system for which the Materials Division had undertaken the task of coating the solar collector panels. Also developed was an effective process for heavy nickel coating of seal discs used in nuclear reactors.

Activity in the development of advanced structural ceramics, identified as a thrust area, was initiated. Studies were being made for making ceramic catalytic ignition cups and silicon nitride stator vanes.

The Structural Sciences Division carried out extensive stress analysis, using NASTRAN software, of the hybrid-composite (metal with CFRP covering) structure of the 1/4th scale LCA high speed air intake model. Excellent correlation was obtained between the results of the stress analysis and the results of static tests carried out on the air intake model. Ground vibration tests were carried out on the HS 748 aircraft partially modified with the addition of two pylons. Natural frequencies and mode shapes were determined. A theoretical study, using a simplified model, was also carried out to determine the dynamic behaviour of HS 748 aircraft with and without rotodome and the associated structural modifications. Evaluation of Al-Li alloys for fatigue crack growth properties under flight simulation loadings, representing the expected service load environment of LCA was completed. Lital-C, the damage tolerant grade of Al-Li alloys, manufactured by ALCAN, UK, showed excellent fatigue crack growth properties (superior to L73). Laminate specimen of Al-Li alloy and Kevlar fibre layers were made and crack growth evaluation of these laminates was taken up.

The Systems Engineering Division completed the work on the development of a mathematical model of the HS 748 aircraft, with and without rotodome, using available data sets from a variety of sources, and exercised the model to simulate flight trajectories for conditions with and without the rotodome. No abnormalities in the behaviour of the rotodomed aircraft were observed for the manoeuvres studies by simulation.

The Division, together with ADA and ASTE (Aircraft Systems and Testing Establishment), performed planned flight tests on an IAF combat aircraft. The flight test data were subjected to comprehensive analysis using parameter estimation methods such as the maximum likelihood estimation technique to obtain the drag polar which compared well with the manufacturer's data. This exercise has, in a way, shown the ability of the Division to conduct planned flight tests, and process the data using parameter estimation techniques, to derive aerodynamic data, lateral and longitudinal stability and control derivatives.

The Division used successfully the parameter estimation techniques to analyze missile flight data to estimate lateral aerodynamic derivatives. Work was also initiated on dynamic wind tunnel testing of the LCA model to estimate stability derivatives. Flight testing of the LCRA, with instrumentation developed and installed by the Division, continued during the year. Considerable progress was made in modifying the 'g' meter developed earlier to fit into the Jaguar aircraft and also in the development of the microprocessor-based version of the 'g' meter.

The CSIR Centre for Mathematical Modelling and Computer

Simulation has significantly enhanced its computing facilities. A large variety of new hardware (including the Cosmos workstation based on the 80486 processor) and software were added. Diverse modelling problems ranging from sedimentary basin modelling to human ankle joints have been studied at the Centre. C-MMACS continued to be active in arranging a large number of meetings and workshops to aid scientists and engineers of CSIR in mathematical modelling.

During the year, 47 papers were published in journals, and 78 presented at symposia/conferences.

NEW PUBLICATIONS

Home-scale Processing and Preservation of Fruits & Vegetables

The Central Food Technological Research Institute (CFTRI), Mysore, has recently brought out the revised and enlarged edition of 'Home-scale Processing and Preservation of Fruits & Vegetables'. Aimed at creating an awareness on the application of modern methods of preparing juice/squash/nectar, canning, drying/dehydration and fermentation at home level, the booklet is expected to be very useful for catering/home-science institutions, hotels, small-scale industries, extension workers, cooperative bodies and housewives. The book gives the broad principles of fruit and vegetable preservation and also the general guidelines for preparation of various products including certain specialized items. Addresses of manufacturers of equipment useful for home-scale processing are also included in the book. The publication (pp 76, price Rs 15 + packing and postage) is available from the Sales & Distribution Officer, CFTRI, Mysore 570 013.

Directory of Online Databases Relevant to Electrochemistry

The Library and Information Sciences Division of the Central Electrochemical Research Institute (CECRI), Karaikudi, has brought out a Directory of Online Databases Relevant to Electrochemistry, containing information on 105 online databases and 16 CDROM databases relevant to chemists/electrochemists. Each entry contains information about a database such as geographical coverage, period covered, type of database, producer(s) of the database, vendor(s), equivalent print products, key terms, main subject, etc. At the end, the following indexes are provided for locating the information fast: producer index, vendor index, print product index, database type index, subject index and keyword index.

The above publication was released by Dr K.V. Mariwala, Chairman, ICMA (Western Region), on the occasion of the CECRI Foundation Day and the Brain-storming Session on Electrochemicals on 25 July 1990.

Further information regarding the publication can be had from: The Director, CECRI, Karaikudi 623 006.

DEPUTATION BRIEFS

Dr M.K. Basu

Dr M.K. Basu of the Indian Institute of Chemical Biology (IICB), Calcutta, visited four laboratories in UK and USA for a month starting from 6 April 1990, under the UNDP-supported project: Molecular biology and biotechnology applied to the study of parasites, with a view to exchanging ideas and collaborating with a foreign laboratory for fruitful execution of the project.

In USA, Dr Basu was deputed first to the laboratory of Prof. K.P. Chang, Department of Microbiology and Immunology, Chicago Medical School, North Chicago, Illinois, for 3 weeks for carrying out some collaborative studies on the modified form of *Leishmania donovani promastigotes* and on the factors responsible for leishmanial virulence.

The promastigotes of *Leishmania donovani* were modified by the method already established in IICB. The microviscosity of modified promastigote membranes were examined by fluorescence depolarization technique using diphenyl hexatriene as the fluorescent probe. The specific activity of a membrane-bound enzyme, gp 63 (acid protease), a factor for leishmanial virulence, was examined using modified and non-modified promastigotes. The microviscosity of the promastigote membrane was found to be higher for the modified ones in comparison to the non-modified ones. A parallel relationship was noticed between membrane microviscosity and the specific activity of gp 63. It was interesting to note that the specific activity of gp 63 increased for the modified promastigotes derived from non-pathogenic strain. For modified promastigotes, derived from pathogenic strain, the specific activity of gp 63 did not increase at all. It is possible that for pathogenic strain of leishmania, the gp 63 is already exposed on the membrane surface. Attempt was made for a possible longterm collaboration aimed at unveiling the causes for virulence between the strains.

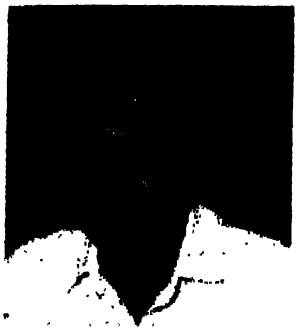
Dr Basu visited laboratory of Prof J. F. Bertles at Columbia University Medical School, New York, during April 27 to 1 May 1990 for gathering knowledge on macrophage activation by utilizing appropriate chemicals. He also visited the laboratory of Prof. D.

Schachter which helped him in updating his knowledge on membrane microviscosity and its possible role in macrophage-parasite interaction.

In the final phase of his trip, he went to UK and met Dr M.L. Chance at Liverpool School of Tropical Medicine (2-6 May 1990) and exchanged knowledge on new anti-leishmanial drugs and their possible use in targeted delivery system in an attempt to reduce drug toxicity and to increase the efficacy of the delivery systems (liposomes and niosomes).

Dr D.V. Singh takes over as Director, CRRI-New Delhi

Dr D.V. Singh, Professor, Mechanical & Industrial Engineering Department, University of Roorkee, Roorkee, has been appointed Director of the Central Road Research Institute (CRRI), New Delhi, w.e.f. 17 August 1990.



Dr Singh (born 11 Dec. 1934) did his B.E. (Mechanical) and B.E. (Civil) in 1956 and 1957 respectively from the University of Roorkee. He joined the Roorkee University's Department of Mechanical & Industrial Engineering as lecturer in 1958, and became Professor in 1967. He obtained his Ph.D. from the University of Wisconsin, U.S.A., with Mechanical Engineering as his major and Highway Engineering as his minor, in 1964. He served as Associate Professor at the North Carolina A&T State University, USA, during January-June 1969, and as Professor at the Military Technical College, Baghdad, Iraq, during September 1977-June 1978.

He was a DAAD Fellow at the Universitat Stuttgart and Technische Universitat Berlin during June-August 1986. He served as Dean, Academic, during 1980-84; Head, Department of Mechanical & Industrial Engineering during 1984-1987; and Dean, Research & Industrial Liaison, during 1983-84, at the Roorkee University.

Dr Singh's main area of work has been dynamics of the Mechanical Systems, Fluid Film Bearings and Seals, Fluid Mechanics, Tyre Mechanics, Tyre Pavement Interactions, Vehicle Skid Dynamics and Vehicle Stability.

Dr Singh is recipient of several prestigious awards: Khosla Research Prize and Silver Medal (1970); Khosla Gold Medal (1971); Certificate of Merit, Institution of Engineers (India)(1973); Corps of Engineers Prize, Institution of Engineers (India)(1974-75); Khosla Research Award (1979); IMDA Silver Jubilee Award (1981); Railway Board's First Prize, Institution of Engineers (India)(1981), and Khosla Silver Medal (1987).

He was awarded the Shanti Swarup Bhatnagar Prize in 1978 for his outstanding contributions in the area of dynamics of single track vehicles and tribology. His work on the tyre-pavement interaction and the dynamic analysis of the frames of vehicles has been used by the industries to improve the design of scooters and utilize indigenous materials in their fabrication. He has also made significant contributions in the field of hydrostatic and hydrodynamic lubrication.

Dr Singh is Fellow of the Institution of Engineers (India), Indian Academy of Science, Indian National Science Academy, Indian National Academy of Engineering, and member of several professional bodies. He has published over 140 research papers in various international and national journals, written many consultancy reports for industries, and supervised 14 doctoral thesis. He has completed various projects sponsored by CSIR, U.P. Government and UP Council of Science & Technology, etc.

Honours & Awards

R.N. Bangur Memorial Award for Dr Paul Ratnasamy

Dr Paul Ratnasamy, Deputy Director and Head of the Inorganic Chemistry Division, National Chemical Laboratory (NCL), Pune, has been awarded the R.N. Bangur Memorial Award for Modernization of Operating Technology for 1989. The award instituted by the Bharat Chamber of Commerce, Calcutta, carries a cash prize of Rs 25,000, a plaque and a certificate.

Dr Ratnasamy, has been actively engaged in the development of novel zeolite catalysts and state-of-the-art technologies based on them. Development of Encilite-1 (for NCL zeolite) for isomerization of xylenes which is being commercially exploited by Indian Petrochemicals Corporation Ltd, Vadodara and Encilite-2 for production of ethylbenzene from ethyl alcohol and benzene (a unique one-step process for the production of ethylbenzene) commercially exploited by Hindustan Polymers, Visakhapat-

nam, are two successes resulting from Dr Ratnasamy's work that have marked India's entry in the high-tech area in the chemical manufacture.

As a result of Dr Ratnasamy's dedicated efforts, NCL has become one of the top five organizations in the world engaged in both basic and applied research in zeolite catalysts and technologies.

Dr B.S.R. Reddy

Dr B.S.R. Reddy, Scientist, Central Leather Research Institute, Madras, has been elected a Fellow of the Royal Society of Chemistry, London, for the year 1990. The election to this prestigious fellowship is in recognition of his achievements and contributions to the advancement of polymer science and technology during his tenure at several leading universities in UK, viz. Queens University, Belfast; Imperial College, London and Bath University, Bath, and his contributions in the area of Leather Auxiliaries at CLRI since 1983.

International Liquid Crystal Society

An International Liquid Crystal Society has been formed recently in response to requests from a large number of liquid crystal scientists and technologists, mainly from Europe, USA and Japan, to provide a forum for the exchange of information between individual scientists and for greater interaction between basic research groups and industry. This was announced at the 13th International Liquid Crystal Conference held in Vancouver, Canada, during 23-27 July 1990. Some of the members of the Board of Directors of this Society are very distinguished names. For example Sivarama Krishna Chandrasekhar, the President, has made pioneering contributions to the theory and application of liquid crystals, and has authored a Cambridge monograph on liquid crystals; M. Schadt, the Vice-President, is the inventor of the 'twisted nematic device' which has generated a billion dollar industry in LCD's; N. Clark and S.T. Lagerwall are the inventors of the ferroelectric liquid crystal display device.

Apart from sponsoring conferences, one of the main functions of the Society will be to publish a magazine *Liquid Crystal Today*, which will report on recent advances in the field, new materials and devices, forthcoming publications and meetings, and advertise job opportunities. It is also proposed to bring out in due course a world directory of 'Liquid Crystallers'.

Membership of the Society includes various categories, ranging from student members to sustaining members (the latter intended for corporations or other business organizations). Special concessions are being worked out for members from soft currency areas.

Application forms for membership may be obtained by writing to: Prof. S. Chandrasekhar, President, ILCB, Raman Research Institute, Bangalore 560080, or Prof. D.A. Dunmur, Secretary, ILCS, Department of Chemistry, University of Sheffield, Sheffield S3 7HF,U.K.

PATENTS FILED

309/DEL/90: A process for the preparation of product having antileishmanial activity from the seeds of the plant *Nyctanthes arbor-tristis* Linn., J.S. Tandon, P.Y. Guru, U.K. Singha, B.N. Mehrotra, A. Rathore, V. Srivastava and A.B. Sen — Central Drug Research Institute, Lucknow.

310/DEL/90: A process for the preparation of crystalline metallo-titanium silicate catalyst composite material, A. Thangaraj, R. Kumar, P. Ratnasamy — National Chemical Laboratory, Pune.

311/DEL/90: A process for the preparation of copper sulphate directly from its sulphide ores concentrates, K. Parida and S.B. Rao — Regional Research Laboratory, Bhubaneswar.

312/DEL/90: A process for the preparation of zinc sulphate from zinc sulphide ore/concentrate and manganese dioxide/manganese ore, K. Parida and S.B. Rao — Regional Research Laboratory, Bhubaneswar.

ANNOUNCEMENTS

National Seminar on Synthesis, Analysis and Applications of Chiral Compounds

A National Seminar on Synthesis, Analysis and Applications of chiral compounds will be held at the Indian Institute of Chemical Technology (IICT), Hyderabad, on 9 and 10 November 1990. The objective of the seminar is to bring together experts engaged in the area of synthesis and analysis of chiral compounds. It is expected that the deliberations will identify major challenges in the area for the 90's and provide a stimulus to both academic and industrial research activities.

The programme will consist of invited talks and contributed papers in the following areas: New strategies in the synthesis of chiral compounds, Modern techniques used for the analysis of optically active compounds; and Use of chiral compounds in drugs, pharmaceuticals and pest management. Further details regarding the seminar can be had from the Convener, National Symposium on Synthesis, Analysis and Application of Chiral Compounds, IICT, Hyderabad 500007.

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CSIR NEWS

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Prof. M.G.K. Menon, Minister of State for Science and Technology and Vice President, CSIR, releasing the CSIR publications: Significant Achievements - 1989, Research Output - 1989, and NRI Directory, at the CSIR Foundation Day function held in New Delhi

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CSIR FOUNDATION DAY CELEBRATIONS

The Council of Scientific & Industrial Research celebrated its Forty-eighth Foundation Day on 26 September. At a function held in the India International Centre, New Delhi, Prof. M.G.K. Menon, Minister of State for Science and Technology and Vice President, CSIR, addressed the CSIR scientists and gave away the 'CSIR Young Scientist Awards' for 1990. He also released the following CSIR publications: Significant Achievements—1989, Research Output—1989, and NRI Directory. Dr A.P. Mitra, Director General, CSIR, announced the CSIR Technology Awards and Shanti Swarup Bhatnagar Prizes for Science & Technology for the year 1989. He also mentioned the names of children of CSIR staff who had shown meritorious performance in 10+2 examinations, and who had been admitted to IITs.

Dr S.R. Valluri, former Director, National Aeronautical Laboratory, Bangalore, delivered the Foundation Day Lecture on R&D Management, Self-reliance and the Need for a New Approach.

CSIR laboratories/institutes celebrated the occasion by arranging special lectures, holding essay/painting competitions for the children of CSIR staff, observing open days, organizing exhibitions and presenting mementoes to the staff members who had retired during the last year and those who had completed 30 years of service in the Council.

CSIR Foundation Day Lecture: 1990*

R&D Management, Self-reliance and the Need for a New Approach

DR S. R. VALLURI
Former Director, National Aeronautical Laboratory, Bangalore

Introduction

In recent times, much has been said about our continued commitment to self-reliance, and taking this country into the group of developed nations. As we approach the end of this century, we note that we have established a reasonable industrial base, manufacturing a variety of consumer and capital goods. But our dependence on developed countries for production of such goods seems to be on the increase. The problem is being debated and liberalization of technology imports, and a wider opening up of the Indian market for others, seems to be on cards through the New Industrial Policy, presumably for a more rapid build-up of the production base.

While we should certainly aim for self-reliance, it is too much to expect that we become so in every sector. In an inter-dependent world economy, it is neither prudent nor economically feasible to plan that way. Yet, self-reliance in crucial sectors of our economy, in particular those that are concerned with high technology industries and defence, is largely inescapable if we wish to call our economic base our own and if we want to join the group of developed nations. It is time we realise that by and large what we have set up with know-how from abroad is an industrial base and not a technology base. The crucial difference between the two is that a technology base is self generating and reduces continued dependence on others and leads to self-reliance whereas an industrial base, for its upgradation, continues to depend upon imported know-how and is most certainly not self generating.

There is little doubt that we have the intrinsic capability for establishing a self generating technology base. It is a matter of defining our commitments and ordering our priorities. We can call ourselves self-reliant only when we can horizontally transfer the technology from one sector to the other, if and when techno-economic and national priorities demand. Only then would the imported technologies truly become a part of the technology fabric of our country. To achieve this objective, long-term strategic planning is a must as the gestation periods are long, particularly for high science-high technology industries.

Strategic planning and trends in developed world

This style of planning calls for establishing close linkages between R&D and the industry. At the strategic level, this is concerned with definition of major national goals, including their scope, nature of the research, technology and hardware development and production tasks proposed to be taken up, and resources required to accomplish the tasks. At the operational level, such planning generates R&D and hardware development programmes in consonance with the strategic plans. Therefore, if the strategic planning is not done carefully, the institutional R&D activities become diffused. Thus, before the

*Abridged version

government asks what the research institutions have achieved, has to ask, "What strategic planning did the government undertake to ensure that the R&D institutions, including those in the public sector, responded to the stated needs". In the developed world, proposals demanding large outlays are scrutinized very carefully to determine what exactly is being proposed, at what cost, in what time-frame, and with what professional manpower. We do not seem to have appreciated the sense of purpose and direction, that such planning can give. It demands discipline and accountability, while delegating authority and responsibility.

Trends in India

Compared to the experience in the developed world in R&D management, the contrast in India is striking. Funding for research institutions has been expected to form an anchor for the growth of an indigenous technology base, as distinct from an industrial manufacturing base. However, for over four decades emphasis has been given in the industry to licence manufacture, in the name of import of latest technologies, without any significant effort to understand the scientific, engineering and design principles underlying such product development. This has resulted in a lack of suitable linkages between the industry and the R&D institutions. In most instances, the R&D institutions did not go beyond applied research and laboratory level technology development. Corporate R&D was no better. Where it existed, the continued soft option of licence production prevented it from taking any major initiative towards self-reliance.

Manufacture of a product under licence from abroad does not make us self-generating. It is simplistic to suggest that the import of know-how for manufacture of a product, howsoever 'latest' its production technology may be, is tantamount to import of latest technologies. It is only when we obtain the scientific, technical, engineering and design principles, which lead to product development, that we can claim to have imported the latest technologies. Otherwise, it is merely a case of import of pure and simple product manufacturing 'know-how' to satisfy demand in a sellers' market.

Of the total R&D investment in Japan, about 70% comes from the industry, 20% from the government and 10% from the universities. The investments by the top ten high-tech industries in Japan are as high as one to two billion dollars with an average of about 1.6 billion and amount to as much as 4 to 10% of sales, with an average of about 7%. In contrast, the Indian investment on R&D in 1986-87 by the industry was of the order of 0.71% of sales and amounted to Rs 555.17 crore (DST R&D Statistics in 1986-87) as compared to about Rs 2865.57 crore by the government. We must realize that technological self-reliance comes not by government investments but by those made by the industry for R&D, while the government investments lay the foundations for it.

When Prime Minister Nehru introduced the Scientific Policy Resolution (SPR) in the Parliament in 1958, it was a recognition of the utter dependence of the country's future on science and technology to increase the standards of living of our people. In agriculture, this policy has more than adequately proved its worth, by ushering in the agricultural revolution. Among others, Atomic Energy and Space established the credentials of the Indian scientists and technologists to rise to the occasion. With far limited financial support compared to Space, Atomic Energy and Defence, it is estimated that in 1989-90 CSIR added about Rs 1000 crores to the annual industrial production, against an R&D investment of Rs 215 crore, the cumulative annual production through CSIR being currently es-

Dr S.R. Valluri, former Director, NAL, who delivered the CSIR Foundation Day Lecture, is receiving a memento from Dr A.P. Mitra, Director General, CSIR

timated at Rs 8600 crore per year. With about 2045 Ph.Ds in its fold, as compared to about 342 or so in DRDO and 995 in DAE (DST R&D statistics 1986-87), it is the most powerful scientific and technological think tank yet created in the country. With purposeful policies, clear input-output linkages with the relevant industries, and appropriate financial support, it is definitely capable of achieving much more.

We have to assume that Nehru expected that the wide higher education and research base and the industrial base set up mostly through imported know-how would start interacting with each other to obtain a self-generating technology base. But in general, in the bulk of the industrial sector, things seem to have been somewhat different. No serious effort has been made in the industrial sector, till recently, to set up design offices and corporate R&D which could have interacted with research laboratories such as those of CSIR. Thirty years after the approval of SPR, planned research and technology development to support the industrial base, do not also appear to be specific parameters of reference in national planning. There does not seem to be reliable mechanisms to monitor the progress towards technological self-reliance in the industry, for that is where the final steps are taken. While the bottom line of profit is an important parameter in determining the operational efficiency of the industries, it is no less important to keep track of efforts to obtain technological self-reliance, particularly in the public sector. This is what the commitment to SPR and the Technology Policy Statement (TPS) is all about. That we have not made much progress, in this direction, is a measure of the alienation that exists betwen R&D and the industry, and a reflection on the implementation of avowed policies.

The product oriented technology requirements of the country are so vast that even 100 CSIRs, cannot begin to make a dent in responding to the needs of the thousands of industries. The industries should take the initiative to selectively draw up on the resources of these institutions through sponsored research programmes and retaining their staff as consultants to pick their brains and direct their capabilities into desired areas. Such linkages did not get established while these for example, are a characteristic feature in the American industry. There is no point in blaming organizations like CSIR laboratories, as long as the industry is reluctant to bridge the technology gap from the laboratory level to the industry level. It costs money to bridge these gaps and resources currently available to the laboratories are utterly inadequate to bridge these gaps without support from the industry which can use such know-how; it is the industry that supports such work abroad.

I am not suggesting that we should not import technologies from abroad. However, the soft option of easy import of 'know-how' for product manufacture; the security and a feeling of accomplishment it offers to the decision makers, in both the industry and the government; a certain lack of resources and reluctance in our country for risk-financing to explore new ideas, which characterises the true entrepreneurial system; a lack of understanding of the problems involved in growing technological self-reliance; and, finally, human frailty and complacency, have all contributed to a situation, where the industry and the R&D worked at cross purposes, instead of functioning as partners in facing exciting challenges. This has inevitably delayed the pace of self-reliance in technology. Import of manufacturing technologies has therefore become inevitable. But it is unlikely that the licensors will give us anything other than manufacturing technologies to set up industries, unless of course the underlying 'know-why' behind this manufacture has already become obsolete. How so ever latest these manufacturing technologies may be, they do not make us self generating. We thus now seem to have Hobson's choice and may well have to strike a Faustian bargain. The only way out would appear to be to make the design offices, the corporate R&D of the industry and the government laboratories responsible for unravelling the scientific, engineering and design principles, that led to the product development and take initiative to develop the next generation products indigenously, so that, as time goes by, we can reduce our continued dependence on others in crucial sectors. If this is not planned and done as a deliberate policy, the alienation among them will continue, and what is worse, widen the technology gaps, leading to continued dependence on production through licences from abroad. This is apart from the unfortunate fact that the really intelligent people will tend to migrate, as there are no challenges in such production, resulting in the now all too familiar brain drain.

In this background, one can only note, with some concern, a statement attributed to the Union Minister of Industries in the Business India 11-24 June 1990 issue. He was stated to have said while talking about the New Industrial Policy: "The clause in the New Policy enabling firms to induct foreign technology without referring to the government will not bring any repetitive technology as believed by some. The idea is to enhance the process of technology upgradation. It does not matter if

this leads to indigenous technology being ignored, as the country requires the best technology possible". This would seem to be not a change in emphasis in earlier policy, but a fundamental shift from avowed policies of the past. The government may wish to re-examine this shift in policy and its long term implications. One would agree that the urgent needs of the people must be met, and this may demand either outright imports or licence production, based upon imported know-how. But then urgent needs arise mostly when long-term planning is lacking.

Adverse influence of licence production on R&D and growth of technological self-reliance

There is precious little that the R&D institutions and corporate R&D and design offices can do, if the industry, public or private, proposes to continue with production based upon imported know-how, in the name of importing latest technologies, without making any serious effort to absorb them. In contrast one may note the strong input-output linkages, forged among the academic and the R&D institutions and the industry, in countries where development and growth are self-generating. We cannot get far particularly in high-tech industries, without a proper R&D support and without forging strong linkages among them, and making long-term plans for them, if we wish to stand on our own feet, without the crutches of continued dependence on licence production, based upon imported 'know-how', by whichever name we may wish to call it. Such programmes can be planned only by people who have relevant experience and a feel for the field. I can do no better than relate an event described in the "New Scientist" 21 May 1987 issue. In 1947, the Nobel Laureate Sir Lawrence Bragg from Cambridge, trying to convince Mellanby, Secretary to the Medical Research Council of United Kingdom, told him that "Perutz and Kendrew were on a treasure hunt with only the remotest chance of success, but that, if they succeeded, the results would provide an insight into the workings of life on the molecular scale". It was a shoestring operation, functioning from a small hut which was subsequently converted to a bicycle shed. The rest is a part of the history of the Laboratory of Molecular Biology (LMB). It unravelled the structure of DNA and established the foundations of molecular biology (and eventually the current revolution of biotechnology the world over). During the forty years of its existence, staff of LMB earned seven Nobel Prizes. It was a classic example of basic research of the highest order, conceived by a scientist who had a feel for the problem, and funded by another scientist in the administrative arm of the government, who had the courage to go off the beaten track, to explore the new, and carried out by carefully chosen men of obvious talent.

Pattern of R&D growth in India and impact of self-reliance

R&D investments to explore new ideas or generate new databases or undertake technology development in anticipation of future requirements in a planned manner have been more an exception than a rule in India. For example, the senior management of a major industry, about a decade ago, took the view, that no significant technology development investments should be made, unless there was a sanction for a major hardware development programme. On the face of it, taking a simple-minded view, it looked like a very prudent and eminently sensible decision, designed to save the government from incurring (to use the famous phrase) 'infructuous expenditure'. The decision, in fact, cut off any meaningful dialogue between the industry and the relevant R&D institutions and inhibited any technology development. In one stroke, this decision not to support forward research and development had effectively destroyed its ability to mount a technologically sophisticated hardware development programme on its own. It is a very heavy price to pay for lack of vision and understanding of the problems involved in growth of technological self-reliance.

As long as we did not make self-reliance a major policy objective, it did not really matter how we organized the industry, and the industry-oriented research laboratories. It did not matter whether we had any corporate R&D and design offices, actively concerned with technology development and absorbing imported technologies and building thereon. It did not matter if those that existed functioned in isolation. It did not matter if people, concerned with planning these activities, did not have the relevant background and neither had time for them. These would have continued to remain fashionable trappings, to impress nontechnical visitors, rather than become prime movers to take the country along the path of self-reliance.

Technological self-reliance cannot be obtained by such measures. The government should demand that the R&D institutions, and the design offices and the corporate R&D of the industry, contribute to the national development in a positive and discernible manner. In this, R&D is not an end in itself but indeed the crucial means to that end. The end purpose is to help grow the technology base, by laying foundations for its use in the industry. And this highlights the necessity for strategic long-term planning for the industry and the R&D institutions, assignment of specific and clearly defined roles

and establishing appropriate linkages among them as a general policy. In such a scenario, the answer to the question "If you succeed in your R&D activity, to whom does your output become an input?" assumes paramount importance and will have been answered before the programme is taken up instead of searching for likely users after an R&D project is completed. Applied research and technology development then become purposeful. This style of management is, generally speaking, characteristic of the developed world.

In developed countries, literally hundreds of R&D projects are supported by the government and the industry, up to the applied research stage, to ascertain their potential. Beyond this stage, it is only those that have market potential that are pursued through the phases of technology development, prototype development and production in the industry, with a further thorough review at each stage. The funds invested for basic and applied research, and preliminary technology development, generally come from the government in one form or the other, except for the multinationals with large resources. Funding for such basic and applied research, which is largely supported by the government, is looked upon as the overhead the society pays to keep its options open. The funds for specific technology development, to be supported mostly by the industry, are considered an overhead on the product to be developed. It is here that production based upon imported know-how effectively cuts the links between research and technology development and product development. If the item has national relevance for defence or other needs, it is generally covered by the government, on a long-term planned basis, through sponsored R&D programmes. The escalation in outlays, from one stage to the next, can be 2 to 5 times or more. Since only a few ideas will eventually lead to successful products, many ideas will have to be tried out, through basic and applied research and initial technology development phases. It is this that prompts the developed world to invest such large sums of money in R&D. Since we are farther behind, we may well have to spend even more funds to bridge selectively the technology gaps in crucial sectors if self-reliance is our goal. There are no simple short-cuts to achieve this objective, no matter how much we wish.

In this regard, we generally seem to start late, after a paper on a new idea appears in a foreign journal or worse still, a product appeares in the market, and continue the activity on a low key for a long time, until the idea gathers dust. No wonder that so few ideas, generated in Indian academic and R&D institutions, have seen through all the phases. It is thus clear that, if technological self-relevance is our objective, there are compelling reasons to protect, and nurture selectively, activities in corporate R&D and design offices in the industry, and the relevant academic and R&D institutions and establish close linkages among them. I believe that we can achieve much more from our wide infrastructural base for science and technology. We are too poor a country to afford the luxury of repetitive imports of product manufacturing know-how in the name of importing latest technologies; and too poor a country to provide inadequate support for corporate R&D in the industry, and undirected research in the research laboratories. It is essential, through restructuring and passing enabling laws where necessary, to plan for coordinated action among the various institutions and hold the concerned heads of the industry, R&D and the government departments jointly responsible for setting up a deliberate pace for technological self reliance. The proposed technological upgradation, by the import of the so called latest technologies which do nothing but manufacture a more recent product, by itself will most certainly not solve our problems.

CSIR Technology Awards: 1989

The Technology Awards are given to recognize, encourage and reward multi-disciplinary team efforts of the scientists in CSIR laboratories/institutes. The organizations and individuals winning these awards for 1989 are:

CSIR SHIELD FOR TECHNOLOGY

(a) Engineering Technology: Awarded to National Aeronautical Laboratory, Bangalore, for its contribution to aerospace engineering.

(b) Process Technology: Awarded to the Indian Institute of Chemical Technology, Hyderabad, for the development of technologies for agro-chemicals.

CSIR TECHNOLOGY PRIZES

(a) Chemical Technology: Awarded to the group at Indian Institute of Petroleum, Dehra Dun, comprising S/Shri B.S. Rawat, S.K. Gupta, J.M. Nagpal, P.C. Gupta and Guru Prasad for the development of process for extraction of aromatics from naphtha stream using sulpholane, and to the group at the National Chemical Laboratory, Pune, comprising Drs P. Ratnasamy, B.S. Rao, I. Balakrishnan, V.P. Shiralkar and A.N. Kotasthane for the development of zeolite catalysts.

(b) Engineering Technology: Awarded to Drs K.N. Raju, P. Sunder, P.K. Dash, K. Asokan, M.C. Venkatesh from the National Aeronautical Laboratory, Ban-

galore, for their contribution towards advances in fatigue and icture mechanics.

Material Technology; Awarded to the group at National Physical Laboratory, New Delhi, comprising Drs O.P. Bahl, L.M. Manocha, G. Bhatia, T.L. Dhami, R.K. Aggarwal for the development of high density carbon-carbon composites and jointly to a group of scientists from the Central Electrochemical Research Institute, Karaikudi, comprising Drs H.V.K. Udupa, R. Thangappan, Krishnamurthy, P. Subbiah, B.R. Yadav, K. Asoken, K. Subramanian and V. Arumugam for the development of titanium substrate insoluble anodes.

Shanti Swarup Bhatnagar Prizes for Science & Technology: 1989

The Shanti Swarup Bhatnagar Prize, instituted in 1957, by CSIR in the memory of its architect and Founder Director, Sir Shanti Swarup Bhatnagar, is today the most coveted award for excellence in science and technology in India. Bhatnagar Prizes, each of Rs 50,000 and a citation alongwith a memento are awarded to the scientists below the age of 45 for their notable and outstanding research, applied or fundamental, done primarily in the country during the five years preceding the year of the award, in the following disciplines: (1) Physical Sciences; (2) Chemical Sciences; (3) Biological Sciences; (4) Engineering Sciences & Technology; (5) Medical Sciences; (6) Mathematical Sciences; and (7) Earth, Atmosphere, Ocean and Planetary Sciences.

The scientists chosen for these prizes for the year 1989 are:

Biological Sciences

The Shanti Swarup Bhatnagar Prize for the year 1989 in Biological Sciences has been awarded to Prof S.C. Lakhotia, Department of Zoology, Banaras Hindu University, Varanasi, and Dr(Mrs) Manju Ray, Department of Pharmacy, Jadavpur University, Calcutta.

Prof. S.C. Lakhotia

Prof. Lakhotia has made outstanding contributions to the fields of cytogenetics and cell biology. His work has shed important light on chromosome organization and replication in *Drosophila* and heat shock response at the 93D locus.

Dr(Mrs) Manju Ray

Dr Ray has firmly placed methylglyoxal, a biochemical enigma for a long time, as an integral component of carbohydrate and intermediary metabolism by isolation, purification and characterization of a series of enzymes involved in its anabolism and catabolism.

Chemical Sciences

The Shanti Swarup Bhatnagar Prize for the year 1989 in Chemical Sciences has been awarded to Prof. Mihir K. Chaudhuri, Department of Chemistry, North Eastern Hill University, Shillong, and Prof S. Chandrasekaran, Department of Organic Chemistry, Indian Institute of Science, Bangalore.

Prof. Mihir K. Chaudhuri

Prof. Chaudhuri has made outstanding contributions for developing new reagents and innovative methods for the synthesis of dioxygen complexes and fluorine compounds of matals and non-metals.

Prof S. Chandrasekaran

Prof. Chandrasekaran has made significant contributions in the domain of organic reaction mechanisms, in the development of novel reagents for organic synthesis and in the blending of these two facets to the creation of carbon constellations in a very imaginative fashion.

Earth, Atmosphere, Ocean & Planetary Sciences

The Shanti Swarup Bhatnagar Prize for the year 1989 in Earth, Atmosphere, Ocean & Planetary Sciences has been awarded to Dr Prem Chand Pandey, Space Applications Centre, Ahmedabad.

Dr Prem Chand Pandey

Dr Pandey has made significant contributions to the development of the technique of microwave remote sensing from satellites for obtaining atmosphere and ocean surface parameters. His concept of combining microwaves with infrared to derive cloud parameters, has been widely acclaimed.

Engineering Sciences

The Shanti Swarup Bhatnagar Prize for the year 1989 in Engineering Sciences has been awarded to Dr Srikumar Banerjee, Bhabha Atomic Research Centre, Bombay, and Dr G. Venkateswara Rao, Vikram Sarabhai Space Centre, Trivandrum.

Dr Srikumar Banerjee

Dr Banerjee has made significant contributions to phase transformations and structure-property correlations in titanium, zirconium and shape-memory alloys. His contributions to devitrification in zirconium base glasses have been highly creative. His work on irradiation-induced order-disorder transformation and phase separation in nickel and molybdenum are highly original.

Dr G. Venkateswara Rao

Dr Rao has made outstanding original contributions in the field of structural mechanics. These include properties of finite elements and non-linearities due to large deformations and material characteristics. He led a team which was

responsible for developing a medium sized general purpose programme designated, FEAST (finite element analysis of structures) suitable for a spectrum of applications in research laboratories and industries. It's use has enabled efficient design and analysis of series of rocket systems in India.

Mathematical Sciences

The Shanti Swarup Bhatnagar Prize for the year 1989 in Mathematical Sciences has been awarded to Prof. Gopal Prasad, Tata Institute of Fundamental Research, Bombay.

Prof. Gopal Prasad

Prof. Gopal Prasad is a leading expert in the theory of algebraic groups and their arithmetic. Among his significant contributions are strong approximation for semi-simple groups over function fields, study of central extensions of β-adic and adelic groups and the computation of the covolume of certain maximal S-arithmetic subgroups. His work reveals his mastery over the most intricate aspects of arithmetic groups and has led to important developments in the field.

Physical Sciences

The Shanti Swarup Bhatnagar Prize for the year 1989 in Physical Sciences has been awarded to Prof. M. Lakshmanan, Bharathidasan University, Tiruchirapalli, and Prof. N.V. Madhusudana, Raman Research Institute, Bangalore.

Prof. M. Lakshmanan

Prof. Lakshmanan has done outstanding work in the area of nonlinear dynamical systems. He has pioneered the use of group theoretic and differential geometric methods exploiting among others Painleve', Lie and Lie-Backlund analyses for exploring integrability and the existence of chaotic regimes. He has shown remarkable ability in inventing unsuspected transformations and finding new variable to expose hidden structures. His work on solitons in one dimensional Heisenberg spin chains is well known. Prof. Lakshmanan's many faceted investigations in nonlinear dynamics have enriched the subject and have made a significant impact in the field.

Prof. N.V. Madhusudana

Prof. Madhusudana has made outstanding contributions to the physics of liquid crystals. He has observed a number of interesting phenomena for the first time, including electromechanical coupling effects in cholesterics and curvature induced suppression of the smectic A phase. He has also made significant theoretical contributions on the importance of antiferroelectric correlations in smectics, relevance of flexoelectricity for a number of striking electrohydrodynamical instabilities and a molecular mechanism for the reentrant nematic phase.

Young Scientist Awards: 1990

CSIR Young Scientists Awards are given to promote excellence in various disciplines of science and technology in the CSIR System. The awards consisting of Rs 10,000, a memento and citation are given to the scientists below the age of 35 years.

The disciplines in which the awards are given are: (1) Physical Sciences including Instrumentation, (2) Earth Sciences, (3) Biological Sciences (4) Chemical Sciences and (5) Engineering Sciences.

The awardees for the year 1990 are:

Biological Sciences

The CSIR Young Scientist Award for the year 1990 in Biological Sciences has been awarded to Dr Laxmi Narain Misra, Central Institute of Medicinal and Aromatic Plants, Lucknow, and Dr Babu Lal Tekwani, Central Drug Research Institute, Lucknow.

Dr Laxmi Narain Misra

Dr Misra has successfully isolated and characterized several new

Recipients of the Young Scientist Awards (1990) with Prof. M.G.K. Menon and Dr A.P. Mitra

natural products with novel carclic skeletons. He has also vered a rare electrocyclic reaction in the area of natural products.

Dr Babu Lal Tekwani

Dr Tekwani has shown that parasites cause degradation/denaturation of the host's hepatic cytochrome P450 system, which in turn affects the drug metabolism in the host.

Chemical Sciences

The CSIR Young Scientist Award for the year 1990 in Chemical Sciences has been awarded to Dr B. Mahipal Reddy, Indian Institute of Chemical Technology, Hyderabad.

Dr B. Mahipal Reddy

Dr Reddy has been doing significant work in the area of catalysis. He has developed efficient catalysts for ammoxidation and hydroprocessing, and has characterized catalysts by chemisorption, spin resonance and X-ray methods. He has also developed carbon supported platinum catalysts with various platinum loading for applications in fuel cells. His work is noted for its thoroughness, novelty and its applications in industry.

Earth, Atmosphere, Ocean & Planetary Sciences

The CSIR-Young Scientist Award for the year 1990 in Earth, Atmosphere, Ocean & Planetary Sciences has been awarded to Dr V. Purnachandra Rao, National Institute of Oceanography, Goa.

Dr V. Purnachandra Rao

Dr Rao has made significant contributions to the understanding of marine phosphorites, black shales and clay minerals of coastal sediments.

Physical Sciences

The CSIR Young Scientist Award for the year 1990 in Physical Sciences has been awarded to Dr H.C. Kandpal, National Physical Laboratory, New Delhi.

Dr H.C. Kandpal

Dr Kandpal has demonstrated through very clever and simple but carefully controlled experiments that the Wolf effect (frequency shift of the light source depending on its coherence) is responsible for the considerable dispersion that exists in the spectro-radiometric standards maintained by national laboratories in different countries. The source of these discrepancies has been argued about for many years, but it is only now that the problem has been resolved through the work of Dr Kandpal. This is an extremely significant contribution to standards and metrology.

PROGRESS REPORTS

ITRC Biennial Scientific Report : 1987-89

The Industrial Toxicology Research Centre (ITRC), Lucknow, according to its biennial scientific report for 1987-89, played during the period a major role in the National Drinking Water Mission, by developing a number of technologies, by conducting water quality assessments, and by organizing training and public awareness programmes. The laboratory developed a portable water analysis kit and fabricated a prototype mobile water analysis laboratory. The kit can conveniently be used for carrying out simple bacteriological and chemical tests, and can be employed for an accurate analysis of fluoride, nitrate and iron. The mobile laboratory is fully equipped to carry out spot analysis of water. Besides determining physical parameters, bacteriological and chemical tests can be performed in the laboratory. It has been designed to use the solar energy and, in addition, has been provided with a 1 kVA generator so that it can function in remote villages where normal electric supply is not available. The technology for the kit was passed on to a firm in Ambala, and an order for 17 water analysis laboratories, received from the concerned Ministry, was placed with another firm. ITRC also developed 'Amrit Kumbh', a lowcost mineral water filter and 'Bact-O'kill', an electronic device to kill bacteria in drinking water.

Water samples from 1000 villages in problem districts of 13 states, covering a population of a little less than 5 lakh were analyzed. The investigations included bacteriological analysis for total coliforms and faecal coliforms and the routine physicochemical parameters: pH, temperature, conductivity, fluoride, nitrate, alkalinity, hardness, residual chlorine and iron. In addition, metal analysis for Cd, Pb, Cr, Mn, Zn, Ni, Co and estimation of pesticide residues were also carried out.

Under the Technology Mission on Edible Oils, oil seeds such as sunflower, groundnut, sesame and mustard were analyzed for the presence of residues of different pesticides. Majority of the samples were found to contain residues of organochlorine pesticides such as DDT, HCH and endosulfan; the concentration of DDT being the highest followed by HCH and endosulfan. In contrast, the residues of organophosphorus pesticides such as quinalphos, monocrotophos and methyl parathion were below the detectable level in all the seeds except for methyl parathion in sunflower seeds. Residues of deltamethrin, cypermethrin and fenvalarate were identified in sunflower seeds only.

The thrust area projects of the laboratory were related to: toxicity of pesticides, heavy metals and hydrocarbons.

Studies on the carcinogenic effects of Mancozeb, a protective fungicide, suggested that it has tumour initiating and promoting property, when applied topically on mouse skin. The carcinogenic and cocarcinogenic potential of diuron, a widely used carbamate herbicide, was evaluated in female Swiss albino mice through topical application on skin. The results suggested that the herbicide is able to initiate the development of tumours in a 2-stage initiation-promotion protocol.

A significant suppression in delayed type hypersensitivity and in phagocytic ability of peritoneal macrophages was observed in rats treated with HCH (100 mg/kg body weight daily for 3 months). No such alterations were observed at lower doses. However, low dose of HCH was found to stimulate both the T-cell and B-cell related immune function in 10 day old mice.

Application of HCH (25 mg/kg/day) on dorsal, ventral and thigh regions of the skin of male rabbits for 30 days resulted in mortality of animals. Morphological changes in skin, liver, kidney, testes and cerebellum together with significant alterations in enzymatic activity and presence of residues of HCH in the blood suggested that the toxicity of HCH resulting from its higher absorption into blood may be severe, when the pesticide comes in contact with the skin of thigh region.

Behavioural and biochemical studies were carried out with regard to Lindane, Malathion and Diazinon. A pseudomonas species, M-3, capable of degrading high concentrations of malathion was isolated from the industrial effluents.

Mechanism of resistance to endosulfan and malathion was studied through comparative profiles of detoxifying enzymes. Induction of most of the detoxifying enzymes due to insecticide selection suggested the presence of metabolic resistance to insecticides.

Screening of the bioefficacy of insecticides, against insects resistant to endosulfan and malathion revealed that diazinon, ethion carbaryl, malathion, parathion, permethrin, fenitrothion and allethrin can be used in order of preference, to combat insect population resistant to endosulfan. Permethrin, allethrin, BHC, DDT, resmethrin and endosulfan were effective in order of preference against pests and vectors resistant to malathion.

Studies were made on mechanism, early diagnosis and prevention of cadmium neurotoxicity Also, substituted dithiocarbamates were studied as antidotes of Cd exposure.

Copper, zinc, cadmium, chromium and lead contents in the hair samples of 114 school going children (8-12 years age group) were analyzed to assess the health hazards of metal pollution in the environment. The metal contents were found to be lower than those reported from other countries. High copper concentration was found to be accompanied by high zinc level in the hair samples.

In a study on nickel toxicity and its antidotes, macrocyclic drugs were found to be potentially advantageous over the other clinically employed chelating agents such as cyclam, a fourteen member cyclic tetramine.

The study on interrelationship between iron deficiency and lead toxicity revealed that, despite common hemotological alterations the differential diagnosis of the two can be made on the basis of blood ALAD and ZPP levels. During lead poisoning, the blood ALAD levels decreased and the ZPP levels increased. On the contrary, during iron deficiency, the blood ALAD levels increased dramatically without any effect on ZPP level.

Low dietary protein accentuated Pb-induced haematopoietic and neurological disorders. Copper supplementation reduced toxic effects of lead. Lead produced dose dependent increase in material toxicity and foetus tail malformation.

Studies were made on the toxicology of hydrocarbons such as cyclohexane, benzene, n-hexane and 2,5-hexanedione. Carcinogenic/cocarcinogenic potential of cyclohexane was evaluated using chronic animal bioassay for tumorogenesis following multistage carcinogenesis protocol and assay of ornithine decarboxylase. The study showed cyclohexane to be a potential second stage tumour promoter.

Regulatory heme as measured by tryptophan pyrrolase was found to be depleted during benzene toxicity. Administration of a single dose (250 µg/100 g b.w.) of polyinosinic polycyticilic acid (Poly IC), an interferon inducer, was found to ameliorate some of the adverse effects of repeated exposure of benzene. The interferon induced by Poly IC appears to be modulating immune system acting in cohort with its anticell proliferative activity and accounts for, in some way, for the beneficial effects, i.e. protection against benzene toxicity.

Abrogation of carbon tetrachloride and cyclophosphamide toxicity was studied using protein A. Also, abrogation of endotoxin (*S. typhimurium*) toxicity was studied by giving pretreatment of protein A. It was found that protein A can abrogate endotoxin toxicity even at a very high concentration of endotoxin, i.e. 400 µg. Protein A pretreatment was found to result in repletion of depressed hepatic MFO enzymes aniline hydroxylase, aminopyrine-N-demethylase and glutathion-S-

transferase levels of endotoxin and reduced the elevated plasma GOT, GPT and alkaline-phosphatase levels towards the normalcy. The mortality was also significantly reduced in animals pretreated with protein A.

Also studied was the antitumor effect of protein A on the growth of established tumors. Other basic studies carried out by ITRC during the period included: Immunopharmacological studies on zinc; Studies on mycotoxins, their detection and prevention; Histopathological changes in the body organs of livestock animals exposed to emissions from an oil refinery; Pulmonary changes induced by coal fly ash from thermal power plants; Changes in some histochemically demonstrable enzymes in macrophages exposed to qurtz dust *in vitro*; Cytotoxicity of particulate dusts on activated macrophages; Sister chromatid exchange frequency and chromosomal aberrations in asbestos factory workers; Protective role of ascorbic acid against asbestos-induced toxicity in rat lung; Effect of fluoride on membranes; Effects of synthetic detergents on fauna and flora; Role of oxygen in skin photosensitization; and Studies on the toxicity of food colours.

The laboratory carried out health surveys of saw mill workers in Lucknow, metalware workers in Moradabad; cotton mill and tannery workers in Kanpur and thermal power plant employees.

A clinical and environmental study was conducted in collaboration with the Department of Microbiology, Sanjay Gandhi Post-Graduate Institute of Medical Sciences, Lucknow, to evaluate the health effects of occupational phosphine exposure. Phosphine concentration in the work environment ranged from 0.17 - 2.11 ppm. The clinical examination of workers, after fumigation revealed minor symptoms which included cough (18.2%), dyspnoea (31.8%), tightness around chest (27.3%), headache (31.8%), giddiness, numbness and lethargy (13.6%) each, anorexia and epigastric pain (18.2%) each. The abnormal physical signs included bilateral diffuse rhonchi and absent ankle reflex in one worker each. Motor nerve conduction velocity of median and peroneal nerves, and sensory conduction velocity of median and sural nerves were normal. The study thus suggested that phosphine exposure in workers is associated with mild to moderate symptoms, which are transient.

A study was conducted on 702 persons in Malihabad, which comprised 493 workers exposed to pesticides and 209 controls. An overall morbidity of 41.7% in the pesticide exposed workers was observed. The respiratory morbidity was 30.4% and 35.8% in the directly and indirectly exposed workers respectively. Pulmonary tuberculosis prevalence (15.2%) was the highest, followed by chronic bronchitis (13.0%), while the rest of the respiratory diseases ranged between 0.4 and 2.7%. The complaints pertaining to central nervous system were reported by 6.9% of the subjects. Polyneuropathy was found among 4.3% cases. Residue analysis of pesticides in soil, water, air, fruit and serum was being carried out every month to note the seasonal/chronological variation.

In the ongoing food monitoring programme, 681 samples of powdered red chillies and 686 samples of turmeric collected from both rural and city markets of all 57 districts of U.P. were screened. For analysis, a newly developed solvent system was employed, which offers quick separation on plain non-coated paper strips. Red chilly powder samples showed 20% adulteration while those of turmeric powder, 3.6%. All adulterated chilly samples were artificially coloured with fat soluble non-prescribed dyes such as Sudan I, Sudan II and Sudan III/IV which are known to be highly toxic. Turmeric samples contained the two popular prohibited dyes, metanil yellow and orange.

During 1987-89, 283 papers were published, and 75 papers presented at the various symposia/seminars. Earnings of the laboratory by way of sponsored projects, consultancy/grant-in-aid projects, S&T mission projects, technology transfers, etc. were Rs 48 lakh and Rs 121 lakh during 1987-88 and 1988-89 respectively. This constituted 21% and 54% of the actual CSIR budget to ITRC for the two years.

NEW PUBLICATIONS

Toxicology Atlas of India: Pesticides

The production and use of various pesticides for agricultural and health purposes has been a major contributing factor towards the success of the green revolution and improvement of public health. However, with the increasing use of pesticides, information on the undesirable non-target effects is being greatly appreciated. Pesticides are toxic chemicals and are known to produce adverse effects on the environment.

The Industrial Toxicology Research Centre (ITRC), Lucknow, has been actively engaged in research and development activities in predictive and preventive toxicology of pesticides. Over 300 publications and several reviews and criteria documents have been prepared on pesticides and ITRC has been actively involved in the formulation of national guidelines for pesticide safety. This has led to the development of a comprehensive database on all aspects of pesticide safety.

Compiling data on pesticide residues alongwith the data for production and use and futuristic extrapolations, the institute published earlier a Toxicology Map of India, V.I. Pesticides. The present atlas based on this document and later information, presents data for: (1) State-wise load of pesticides(2) State-wise consumption of pesticides, (3) State-wise environmental load of pesticides, (4) Number of registered pesticide production units, (5) Residue levels in foods and human, (6) Toxicity of pesticides, clinical symptoms, first-aid, environmental risks, persistence and disaster management, (7) Organochlorine pesticide residues in drinking water, (8) Major reported cases of pesticide poisoning and (9) Organochlorine pesticide residues in the waters of Ganga, Yamuna and Hoogli. The publication also contains chapters on hazard classification of some selected pesticides and on environmental risk analysis for major pesticides in India.

The atlas (compiled by: Farhat N. Jaffery, P.N. Viswanathan, B.D. Bhattacharji, Poonam Kakkar, R.B. Raizada, T.S.S. Dikshith, K.P. Singh, Musleh Ahmed, M.U. Beg, R.M. Kidwai, S.N. Agarwal, S.V. Chandra and P.K. Ray; edited and published by P.K. Ray; pp. 72 and 30 maps) can be obtained by placing orders with: Shri S.N. Agarwal, Senior Library Officer, ITRC, P.O. Box 80, Mahatma Gandhi Marg, Lucknow 226 001.

Honours & Awards

UNESCO Honour for CCMB

The Centre for Cellular and Molecular Biology (CCMB), Hyderabad, has been chosen to be a part of the world-wide network of scientific research institutions in the area of cellular and molecular biology, by a committee appointed by the UNESCO's Director General, Prof. Sederico Mayor.

This rare honour is conferred on a very few prestigious institutions in the world. The announcement regarding the selection of CCMB came recently from the Chairman of UNESCO's Executive Committee, Prof. Angelo Azzi, who observed that: "What played a determining role in selecting the CCMB for this honour are its scientific activities and achievements, its highly qualified and internationally known staff, and the modern research projects of the institute".

Dr Ashok Pandey

Dr Ashok Pandey, Regional Research Laboratory (RRL), Trivandrum, has won the 'Young Scientist Award - 1989' of the Department of Science, Technology and Environment, Government of Kerala, for his work on Bioenergy Production and Pollution Control Strategies for Natural Rubber Effluent.

PATENTS FILED

434/DEL/90: A process for the synthesis of Nα-glycyl, N-δ-(L-alanyl-D-isoglutaminyl)-L-lysyl-N-alkyl amides possessing high immunostimulant activity, W. Haq, A. Puri, B. Kundu, R.P. Saxena, A. Kapil, K.B. Mathur and K.C. Saxena — Central Drug Research Institute, Lucknow.

435/DEL/90: A process for making novel low silver brazing filler alloy for electronics and vacuum tube industries, S.C. Dev, P. Basak, O.N. Mohanty, R.K. Dubey and K.G. Sengupta — National Metallurgical Laboratory, Jamshedpur.

436/DEL/90: An improved process for the production of electrolytic iron powder from sponge iron fines, R.R. Dash, S.K. Singh, R. Bhattacharjee National Metallurgical Laboratory, Jamshedpur and B. Kishora — Tata Iron & Steel Co., Jamshedpur.

448/DEL/90: A process for the preparation of a formulation/system based on suitable polymers useful for controlled release of pesticides in aquatic habitats, S. Malik, S.N. Mukherjee and R. N. Sharma — National Chemical Laboratory, Pune.

449/DEL/90: A process for the preparation of compounds useful for the treatment of diseases affecting macrophages, A. Mukhopadhyay, G. Chaudhuri, S.K. Arora, S. Sehgal and S.K. Basu — Institute of Microbial Technology, Chandigarh.

480/DEL/90: A process for the oxidation of saturated hydrocarbons, M.M. Taqui Khan, S.H.R. Abdi, C. Ramachandraiah, S.A.Mirza — Central Salt and Marine Chemicals Research Institute, Bhavnagar.

493/DEL/90: A process for cathodic deposition of a resin over metal sheets, S. Guruviah, P. Jayakrishnan and S. Muthukrishnan — Central Electrochemical Research Institute, Karaikudi.

499/DEL/90: A composition useful for enhancing and controlling the flowering in bamboo species, R.S. Nadgauda, V.A. Parasharami and A.F. Mascarenhas — National Chemical Laboratory, Pune.

620/DEL/90: An improved process for making low silver brazing filler alloy for electronics industry, S.C. Dev, P. Basak, O.N. Mohanty and Inder Singh — National Metallurgical Laboratory, Jamshedpur.

621/DEL/90: A process for the generation of inert gas by fluidized bed combustion of coal, lignite or waste fuels, S.K. Verma, M.K. Mukherjee, B.K. Mall, T.K. Bhowmik, N. C. Bhattacharya, S.K. Maitra, G.S. Dutta, R.R. Biswas, M.M. Sen, S.K. Majumdar and R. Haque — Central Fuel Research Institute, Dhanbad.

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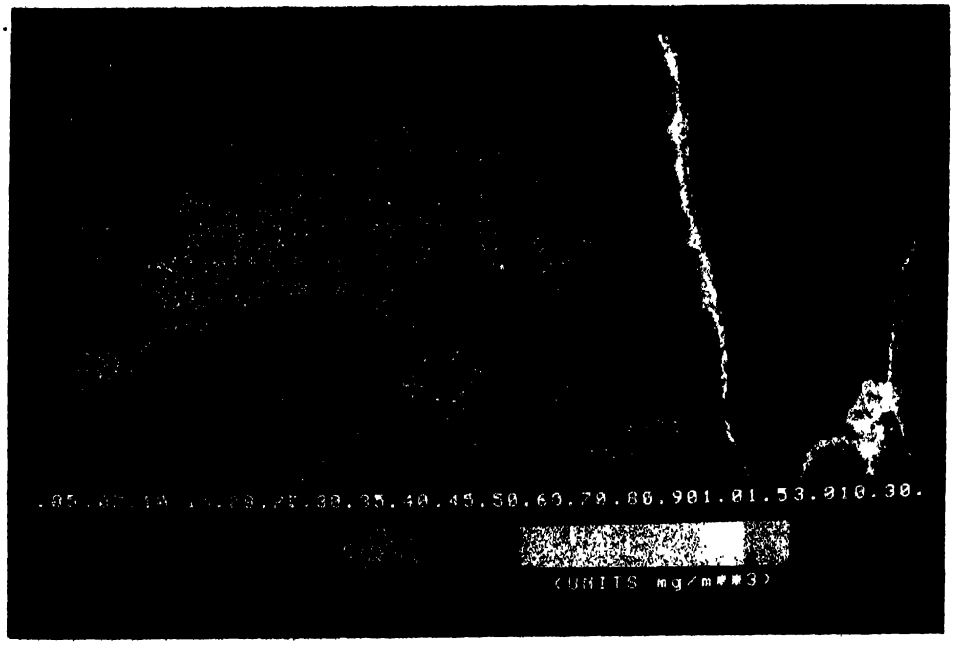

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Chlorophyll concentration in the surface waters of Arabian Sea, deduced from the satellite (Nimbus-7) data (top), and automatic tide gauge deckpit with printer, developed by the National Institute of Oceanography, Goa. A report on R&D highlights of the Institute, for 1989-90, appears on p.240

NATIONAL INSTITUTE OF OCEANOGRAPHY, GOA

R&D Highlights: 1989-90

The major thrust programme of the National Institute of Oceanography (NIO), Goa, during 1989-90, was the oceanographic studies in the Exclusive Economic Zone (EEZ) of the country. The institute also continued its activities under the national programmes on: Survey of Polymetallic Nodules and Antarctic Oceanography. Apart from these, bilateral programmes: (1) Indo-FRG Programme on Quaternary Upwelling and Climate in the Arabian Sea, (2) Indo-US Programmes on Bioactive Substances from the Indian Ocean and Accelerated Corrosion of Metals and Alloys in the Marine Environment, and (3) Indo-USSR Programmes on the Trans-Indian Ocean Geo-traverses Studies and Air-Sea Interaction in relation to Monsoon Dynamics, were also pursued.

Polymetallic Nodules from the Central Indian Ocean

During the year, 629 freefall grab and 103 photograb operations were carried out at 140 stations in the Central Indian Ocean for collecting nodule samples. Maximum abundance of nodules was found to be 27 kg/sq.m. The chemical analyses indicated that average moisture content of these nodules is 20% (range 16-25%), the Mn content varies between 15 and 34%, and Fe content between 2 and 16%. From the analyses it was observed that 39% of nodule samples are marginal and/or paramarginal in grade (i.e. combined Ni, Cu, and Co values above 2%), while the rest are submarginal (Cu+Ni+Co < 2%). The higher concentration of Mn, Cu and Ni in nodules was found to be associated with siliceous sedimentary environment while reverse was true in red clay sediments.

A programme was developed for digitization of seabed photographs to compute coverage and abundance of polymetallic nodules. Photographs of nodule-bearing areas of seafloor showed widespread mega benthic activity. Sediments were the most preferred substrate for organisms followed by nodules.

Antarctic Oceanography

The institute continued its participation in the Antarctic Expeditions. The Ninth Expedition had two scientists from NIO. The studies on the data collected during the earlier expeditions revealed the following:

The decreasing trend in the SST (from -0.5°C to -1.9°C) observed during January 1988, in the shore polynya off Dakshin Gangotri is mainly owing to the processes of heat advection. The presence of anomalous warm saline waters (14°C & 35.3×10^{-3}S) in the upper 1000m of the southwestern Indian Ocean sector of the Southern Ocean suggests the presence of eddies (300 km) that might shed out from the Antarctic Circumpolar Current due to topographic influence of Crozet Plateau.

The planetary scale fronts (thermal and/or saline) in the Indian Ocean sector of the Southern Ocean have considerable east to west variability in their characteristics on account of continental boundary processes and bottom topographic effects.

The analysis of the high resolution seismic reflection data of the Astrid Ridge of Dronning Maudland, east Antarctica revealed seaward, prograded, tectonically controlled graben, about 20 km in width and 80-90 km in length, and other structural elements in the southern Indian Ocean. Its three graben stages — well developed, intermittent and deformed — were attributed to horizontal forces of translation leading to states of compression and elongation across the diverging SWIR plate boundaries and the changes in relative motion of African, Indian and Antarctica continental plates during the Late-Middle Jurassic (120 Ma) to Oligocene (23 - 30 Ma).

Oceanography of the EEZ of India

Ocean Dynamics : Most of the coastal currents that arise along the eastern boundaries of the ocean basins flow with the local winds. The coastal current off western India during the northeast monsoon, however, behaves differently. It flows northward against southward winds. The analysis of data suggested that the momentum to overcome the winds is supplied by a pressure gradient that arises along the coast during the season. Also as the southwest monsoon sets in, the pressure gradient drops and the winds begin to play a leading role. During this season, the surface flow is equatorward and there is a deeper flow in the opposite direction — the coastal undercurrent. This means that the region during the southwest monsoon behaves like a typical wind-driven eastern boundary coastal upwelling system. These results show that the region is unique because of the dramatic changes it exhibits from season to season.

Currents at approximately 1000 and 3000 m depth, along the 15°N latitude were studied in the mid Arabian Sea during May 1986-May 1987. Though the spectra for the six time-series measurements were found to have similar shapes, their energy levels differed. At the western side, the energy in the deeper currents was higher than that at the upper level. The increase in energy from upper to deeper level was marginal at the central mooring and was not

significant at the eastern mooring. The energies dropped from the west to the east, both at the upper and the lower levels, but the drop was much larger in the deeper currents. There was no significant coherence between upper and lower currents at any location, nor between currents at adjacent locations.

Acoustic Tomography: The processed oceanographic data of the Bay of Bengal during 1988 enabled identification of the depth of minimum sound speed to be at 1700 m. Assuming a sound source situated at this depth, the ideal locations of the acoustic receiver(s) that provide the best information of the oceanic environment, were computed using the software developed indigenously. The analysis enabled building up of the data kernel consisting of travel time perturbations of the acoustic eigen rays, and ray path lengths in different (tomographic) layers of the medium were determined based on the vertical sound speed gradients.

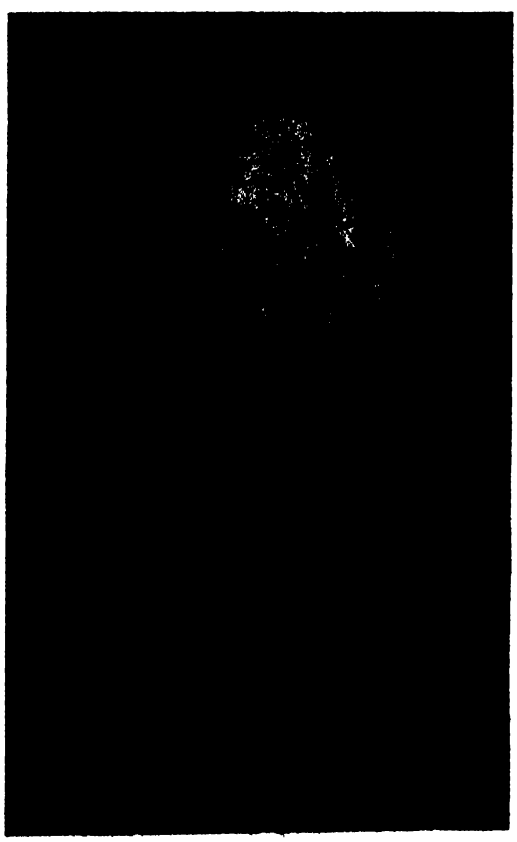
Computer simulation studies enabled reconstruction of sound speed profiles (utilizing the data kernel consisting of acoustic ray path lengths in tomographic layers obtained following ray theory) through the use of singular value decomposition (SVD) technique under generalized inverse method. The results were within the acceptable limits of variance (99%). The impact of noise, either ambient or through mooring motions, incorporated by way of travel time differences was found to improve the space resolutions in the model.

Modelling: A one-dimensional model of marine atmospheric boundary layer that could predict the vertical structure of wind, temperature and moisture was developed and tested for a region in the Arabian Sea. The model predicted reasonably well the vertical structure of wind and temperature field.

A three-dimensional model of circulation in the Arabian Sea was developed. The model has 31 layers in the vertical and takes into consideration the actual bottom topography. Numerical experiments were performed for a one-degree spatial resolution model using climatic data of wind field, temperature and salinity. The model simulated well the climatic circulation in the Arabian Sea for several months.

Remote Sensing: A technique was developed to process optical data collected in the sea. Using this technique, marine optical properties for both downwelling and upwelling light at spectral intervals of 4 nm can be computed for application in optical remote sensing.

A software package was developed to process Coastal Zone Colour Scanner (CZCS) data, which removes atmospheric effects and generates chlorophyll dis-



Dorsal view of a horse shoe crab collected from Orissa coast (left), and artificially fertilized eggs of horse shoe crab

tribution. Several scenes over the Indian Ocean for 1980-85 were analyzed and studied using the newly developed software.

AVHRR data pertaining to Indian Ocean were processed to retrieve SST using the newly developed software. Error estimates of MCSST retrievals in the Arabian Sea were made by the intercomparison of SSTs from ARGOS drifting buoys and SSTs retrieved from NOAA/AVHRR data using the newly developed software.

Chemical Studies: The cycling of the greenhouse gas nitrous oxide (N_2O) was examined in the northern Indian Ocean, and its ocean-atmosphere flux was quantified. Evaluation of the mechanisms of N_2O production in the ocean led to suggest that a novel nitrification-denitrification couple, NH_4—NO—N_2O could be the dominant mechanism for N_2O production.

Enzymatic measurements involving the activity of the respiratory electron transport system (ETS) were made for estimating the oxygen consumption and denitrification rates in the Arabian Sea. The respiration rates observed are among the highest found anywhere in the ocean. The ETS data estabished the Arabian Sea as the single largest denitrification site with a very short turnover time of intermediate watermasses.

A link was established between the surface circulation and the development and intensity of the sub-surface oxygen minimum. This has implications on the long-term geochemical cycling of nitrogen and possibly climate in that the intense north-east monsoon during the ice ages could have led to the weakening of the winter stratification resulting in disturbed intermediate oxygen balance.

Budgets of carbon and nitrogen in the Arabian Sea were computed. A negative trend observed in carbon suggested input through Antarctic Deep Water, while a positive balance in nitrogen indicated its contribution to the atmosphere.

Marine Pollution : Environmental studies in mid-estuarine stretch of Hooghly between Haldia river and Diamond Harbour indicated high dominance of riverine freshwater flow upstream of Haldia. Tides in the mouth caused surface gradients which resulted in propagation of gravity waves into the estuary. The water quality of the lower estuary did not reveal any serious contamination, though Hooghly in its upper reaches is considered to receive 93 x $10^4 m^3$/day of wastewater. Although substantial waste of hydrocarbon origin is considered to be entering Hooghly through port operations and industrial/domestic wastewater discharges, the levels of residues of petroleum hydrocarbons in the water column were fairly low.

Mapping of pesticides residue in the surficial sediments along the coast of India was completed. Concentrations of organochlorines in the east coast sediments were found to be about an order of magnitude higher than those in the west coast sediments. This is because of the use-pattern of pesticides in the country.

Analyses of organochlorine pesticides in edible fishes indicated higher concentration of the metabolite DDE in relation to total DDT. This suggests either a decreasing input of DDT to the Indian coastal marine environment or faster rate of conversion of DDT to DDE owing to higher metabolic activities in migratory fishes.

Biological Studies : Time series mapping of primary, secondary and benthic production in the EEZ along the west coast of India was completed and delineation of the demersal fishery resources was carried out.

Studies on picoplankton indicated that they can tolerate high intensity light. This is contrary to the earlier view that picoplankters are low-light adapted. This finding implies that we have to revise the existing understanding of the food chain with a simple progression from phytoplankton zooplankton fish so as to include an alternative grazing pathway via microflagellates, since picoplankton are not a preferred food source for zooplankton.

Towards the biomedical preparation of lysate, a breakthrough was achieved in the controlled breeding and hatching of young ones of horse-shoe crab *(Trachypleus gigas)* -- a living fossil. The whole life-cycle of the living fossil was successfully studied under laboratory conditions. This was done for the first time, anywhere in the world. The implications of results have significance in the production of Lysate Amoebocyte Limulus (LAL) — a commercially important import substitute.

A detailed study of the estuarine fungi of the Cochin backwaters covering systematics, ecology and biochemical activities was completed. It was found that they play a major role in the microbial degradation of biopolymers of plant origin. Potential role of yeasts in combating estuarine pollution was also indicated by their ability to grow in diesel and kerosene.

Sulphate reducing bacteria (SRB) are anaerobes responsible for the terminal phases of biodegradation. Studies on ecology and physiology revealed the qualitative and quantitative contribution of SRBs in the breakdown of toxic compounds, viz. phenolics and nutrient cycling. Oxidative counterparts, viz. sulphur oxidizing *Thiobacillus*, isolated from offshore waters were trained in the laboratory to mitigate sulphide production in the offshore oilfields.

One hundred thirty-two near-

shore and offshore bacterial strains from waters of the Arabian Sea were tested for their tolerance against nine metals (Cd, Pb, Mo, Co, Zn, Fe, Mn, Hg, Ni) and six antibiotics (tetracycline, penicillin, neomycin, kanamycin, gentamycin, and chloromaphenicol). Though most of the strains were resistant to penicillin, offshore strains showed higher tolerance to metals and antibiotics. They also exhibited multiple drug resistance. Among the pigmented strains, the offshore strains were found to be more resistant to metals than their coastal counterparts and were also comparatively more tolerant to metals and antibiotics at higher concentration than the non-pigmented isolates.

Nitrification by reef corals was found to be quantitatively important with an average rate of 9.4 to 6.0 nmol (mg coral tissue N)$^{-1}$h^{-1}. This is a novel mechanism of N recycling within a coral reef. Ammonium utilization rates were found to be equal to inorganic N production rates and nitrate production rates equal to zooxanthollar uptake rates, demonstrating a close coupling between these processes.

Geological and Geophysical Studies: As part of engineering predesign investigations, high resolution geophysical surveys were carried out in and around Bombay harbour. The seabed topography was found to be smooth over the clay covered areas and uneven where either the bedrock outcrops or the sea floor was formed of stiff clay. Recent sediments, comprising mostly unconsolidated clay (max. 16 m) were found to overlie generally on a fractured, weathered/eroded bedrock which is the continuation of the onshore Deccan flood basalts. Buried channels, interbedded sand bodies, small scale ripples, scouring of the seabed and gas charged sediments were identified.

Detailed bathymetric, side scan sonar, shallow seismic and magnetic surveys were carried out off Karwar, and suggestions were made for planning and design for the construction of the proposed naval base (Sea Bird Project), the biggest in Asia.

A prominent EW trending lineament with a NW offset across the shelf and a thick consolidated sediment layer deposited over the horst and graben like features within the granitic layer were observed off Karwar, as a part of geophysical studies of the western continental margin.

Studies of magnetic anomalies in the Central Indian Ocean Basin between 9° and 16°30'S resulted in the identification of EW trending sea floor spreading anomalies numbering 21 to 25 and a new fracture zone at 75°45'E trending N12°E. The differential offsets observed across the new fracture zones were explained in terms of the evolution of the Indian Ocean Triple Junction.

Continuous seismic profiler, magnetic and bathymetric data collected over the EEZ of east coast of India were analyzed. Magnetic data presented a broad magnetic low over the shelf edge between Paradeep and Visakhapatnam. It was interrupted by a magnetic high off Chilka Lake. The magnetic anomalies in the Krishna-Godavari basin were fairly smooth but also presented isolated magnetic lows over the continental shelf and a linear anomaly parallel to the coast over the continental slope. The bathymetric contours revealed the presence of a ridge off Godavari river, which was not reported earlier. It runs perpendicular to the coast and extends up to about 3000 m water depth. Similar ridge but of less relief was also recorded to the south of Visakhapatnam.

Marine Biodeterioration: Methods to evaluate microfouling were developed. Implication of suspended matter and particulate organic carbon of seawater on microfouling was reported for the first time.

A new approach was suggested to characterize microfouling material based on sugar monomer ratios. A technique was developed and tried to measure shearforce required for removal of calcarious fouling biomass from different surfaces with the help of electronic UTM. The results obtained for different thickness of fouling assemblage suggest that more force is required for removal of fouling in wet condition than in dry condition.

Observations on the corrosion of reinforcement in concrete under varying stresses in marine environment indicated increase of corrosion with increased stress.

Ocean Engineering : Software was developed to retrieve and analyze the raw data on heave/pitch/roll time series to obtain directional wave spectra. Estimation of 100 year wave height (Hs) was made based on the directional wave data so far collected off Karwar. A software was developed for dynamic analysis of single point surface buoy mooring. An online data acquisition system was developed for Aanderaa weather station and self recording currentmeter. A nearshore wave transformation model was developed to study the change in wave characteristics off Karwar coast.

Marine Instrumentation: Final design aspects of the optics for an in-water spectral radiometer (UNDP Project) were completed. NIO is the only oceanographic laboratory where this type of instrument, with specified range and resolution, is being developed.

An integrated data acquisition system was developed for a coastal research vessel. The system consists of personal computers dedi-

cated to acquisition of data from various shipboard equipment.

The technical knowhow of the automatic tide gauge was released to the Department of Science and Technology, who was working out details to release it to M/s AIMIL for full scale production. This unit would be used as a standard one at the Survey of India's tide gauge stations along the Indian coasts.

During the year, technical knowhow of three instruments, viz. direct-reading current meter, wind recorder and electronic bathythermograph were released to NRDC.

Marine Archaeology : Underwater search for the submerged city of ancient Dwarka on Gujarat coast, conducted in December 1989, brought to light hitherto unknown protection walls, bastions, etc., in 6 to 10 m water depth, 1 km west of the temple of Sea God, thereby confirming that the ancient porticity of 1500 B.C. was built on both banks of the river Gomati. The structures, stone anchors and other artifacts were documented. The geophysical survey of an area of 5 x 10 km up to 20 m depth yielded useful data for determining the limit of the ancient city. The submerged channel of the Gomati was also traced and its steep gradient suggests that light artifacts were transported into the then sea about 1.75 km off the Samudranarayana Temple.

Indo-USSR Programme in Oceanology

Data on air-sea interaction processes in relation to monsoon dynamics were collected using Russian and Indian vessels. A one dimensional model that could predict the vertical structure of wind, temperature and moisture was developed and tested for one point in the Arabian Sea. Using the data collected during Monex- 79 expedition as initial profile, simulation was carried out for one day. The model predicted reasonably well the vertical structure of wind and temperature field.

Indo-FRG Project on Quaternary Upwelling and Climate in the Arabian Sea

Seasonality in lithogenic sedimentation rates was observed with high fluxes during the SW monsoon period during times of high biological productivity. The lithogenic flux correlated well with organic carbon flux providing strong evidence for biological control on lithogenic sedimentation.

Particulate matter collected at 732 and 2914m during a time-series sediment trap experiment (sampling interval 13 days) in the Central Arabian Sea (14°29'N 64°46'E; water depth 4016 m) was analyzed for its fatty acid and organic carbon contents. Contents of organic carbon and fatty acids were found to decrease with increasing particle fluxes. At 732 m, fatty acids accounted for 0.6-2% of organic carbon. Particulate organic matter collected during high-productivity and high-flux periods exhibited signs of less intense degradation within the surface layers. Furthermore, loss rates of organic carbon and fatty acids between 732 and 2914 m increased with increasing particle flux, which suggests that water column degradation is intensified during this period.

Indo-US Project on Bioactive Substances from the Indian Ocean

Chemicals indicating analgesic, spermicidal, oxytoxic and hypotensive activities in a mangrove plant, a seaweed and a soft coral were identified, isolated and characteried. They were being synthesized in the laboratory. The synthetic chemical indicating spermicidal activity was in the process of confirmatory tests. Eleven new species of gorgonians, soft coral, zoantharians and seven new species of sponges were discovered.

The active analgesic compound in the mangrove plant *Acanthus illicifolius* was identified as 2-benzoxalinone. This was synthesized in adequate quantity and was awaiting a thorough pharmacological screening. The active anti-implantation compound in the seaweed *Acanthophora spicifera* was identified as aurantiamide. This was being synthesized in adequate quantity.

Active compounds were also isolated from the extracts of (i) algae *Amphiroa fragilissima* - amino compound with oxytoxic activity and (ii) sponge *Haliclona* sp. - coloured aromatic compound with hypotensive activity.

Data Products

The data products brought out during the year include MBT data reports, BT data atlas, Nansen cast data report, Surface meteorological data report, Inventory report of 13 geophysical cruises.

Training Caribbean Scientists

A training programme in oceanography for 22 scientists from nine Caribbean Commonwealth countries was conducted at NIO from October to December 1989. This programme was developed by the Commonwealth Science Council (CSC) in collaboration with the Government of India (CSIR and DOD) and the Caribbean Commonwealth. The objectives of the Caribbean Oceanographic Resources Exploration (CORE) Project are: to enhance the capability of Caribbean countries in investigating, understanding and utilizing their living and non-living resources; to train Caribbean scientists in the classroom, laboratory and onboard ship in areas of oceanography and to carry out the oceanographic resources survey in the Caribbean Sea.

Distributed Information Centre of BTIS at CCMB

The Biotechnology Information System (BTIS), functioning under the Ministry of Science and Technology, is a national network providing information in different areas of biotechnology. Established in 1986, BTIS operates through its nine Distributed Information Centres (DICs), located in various institutions all over the country. One of the foremost functions of the DICs is to disseminate information through activities like providing bibliographic and biological information, software, sequence analysis, etc.

One of the DICs is housed in the Centre for Cellular and Molecular Biology (CCMB), Hyderabad. The principal objective of this DIC is to serve as an information base in the area of Oncogenes, Reproductive Physiology, Cell Transformation, Nucleic Acid and Protein Sequences, and to provide ready access to computer-based information on resources in these areas.

DIC at CCMB has the following computer systems: MicroVAX-11, IBM PC/ATs & XTs, PDP 11/23, terminal for NEC-S1000 at the National Informatics Centre (NIC), Southern Region at Hyderabad, and terminal for CYBER 180 terminal at the National Geophysical Research Institute, Hyderabad (being procured).

Databases available on IBM PC/AT

Medline (1983 onwards): This is a bibliographic database of the National Library of Medicine (NLM) containing information from biomedical literature. It also contains all the references that appear in Index Medicus, Index to Dental Literature, and International Nursing Index. In addition, it also contains complete references to articles from more than 3,200 journals covering topics such as microbiology, biological sciences, nutrition, environmental health, health care, and pharmacology. The database is updated every month.

LiMB: Listing of Molecular Biology (LiMB) is a catalogue of various data bases in life sciences from NLM. It contains information such as the source of the data, funding base, whether available on-line or off-line, nature of medium, scope and size of the database, address for acquiring the data, etc.

GenBank: Genetic Sequence Databank (GenBank) from the European Molecular Biology Laboratory, Heidelberg, FRG, is a database on nucleic acid sequences. The sequence data are broken down into separate files depending upon the organism. The databank is organized into the following sections: primates, mammals, vertebrates, invertebrates, plants, proteins, organelles, and structural RNA of virus, phage and bacteria. Updates are released once in three months.

VecBase: VecBase is a database containing cloning vector sequences for a large number of commonly used cloning vectors. Each vector in the database is listed as a separate file in a pseudo-GenBank format. Updates are released once in a year

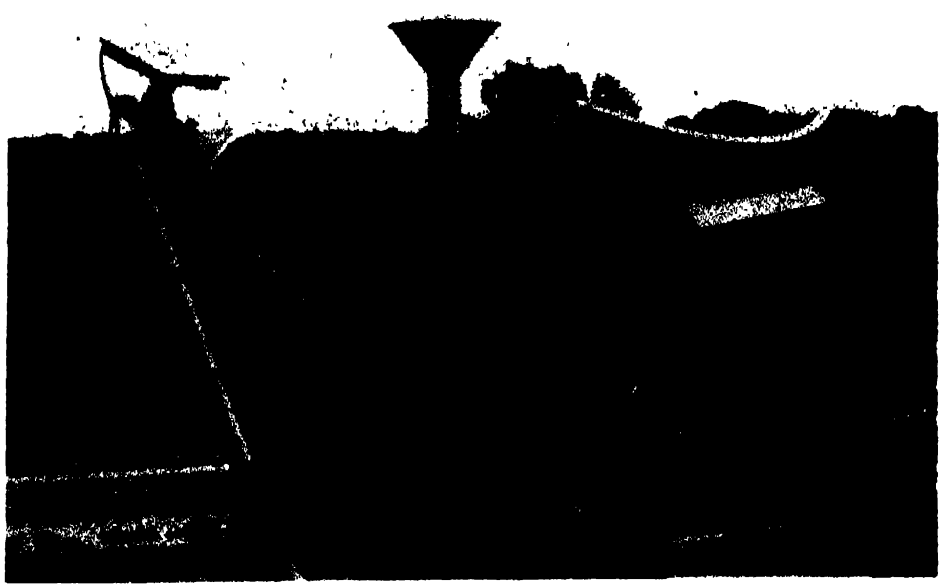
Databases available on Microvax-II

SWISS-PROT: It is a database of protein sequences from the European Molecular Biology Laboratory, Heidelberg, FRG, containing protein sequences and related data. The format is similar to GenBank. Updates are released once in six months.

EMBL: A database of Nucleic acid sequences from the European Molecular Biology Laboratory, EMBL contains nucleotide sequences, index terms, literature citations and taxonomic identifications. The database is organized into sections in a manner similar to the GenBank database. Updates are released once in six months.

Restriction Sites: Eukaryotic promoter sequence databases from EMBL.

PDB: Protein Data Bank (PDB) from Brookhaven is a database giving protein structure atomic coordinates. This contains results of macromolecular structural studies



Micro-earth station with roof top antenna and controller connecting DIC to other stations

all over the world. The information available for molecules includes atomic coordinates, functional features, literature citations and properties.

Databases available on NEC-S1000

SWISS-PROT: Same as SWISS-PROT version available on Microvax-II.

EMBL: Same as the EMBL version available on Microvax-II.

The software available at DIC, Hyderabad includes: (1) Software on IBM PC/AT procured from other sources: PCGENE, GENBANK, MOLGRAPH, MOLDRAW, MULTI-ALIGN, PREDICT,S TATPACK, XTALK, SIGMAPLOT, ENZYME KINETICS, GENCODE, MOL-BIOL,PROPUTEC ISIS, SCIMATE, DTMM and DIALOG. (2) Software on IBM PC/AT developed at CCMB: PROSYN, STINEX, GENERAL PLOT PROGRAMS and DNA FINGER PRINTING, (3) Software procured for MicroVAX-II from other sources — This, in addition to languages like BASIC, FORTRAN, PASCAL, C And LISP, includes GKS, IMSL, Ethernet connection, RDBMS, Protein Crystal Structure Programs, EMBL, Nucleotide Analysis and other important programmes such as STADEN, AUGUR, AMBER, FIND-TRNA, FOLD-RNA and PLUTO. (4) Software for MicroVAX-11 developed at CCMB — PRKSQ, PEPFRQ, HMCNSM, PROSER, AMIRES, PROSEQ, DEVRES, REPLIX, HYDPRO, TAPPRO, STRCOM, SERPRO, PHILOG, DIL-SUL, TANDEM and CODIND (5) Software available on NEC S-1000 system. This includes various programming languages like FORTRAN, PASCAL, C And COBAL and INQ DBMS.

Further information regarding the services and facilities available at the Centre can be obtained from: Dr M.W. Pandit, Co-ordinator, DIC-Bioinformatics, CCMB, Hyderabad 500007.

Anti-corrosion Treatment for Steel Reinforcement Rods in RCC

The Central Electrochemical Research Institute (CECRI), Karaikudi, has developed a process for anti-corrosion treatment of steel rods in RCC. The process, covered under the Indian Patent Nos. 109897, 109784, 112440 and 144639, essentially consists of the following four steps: (i) Derusting of rods by dipping them in a derusting solution to obtain a bright surface; (ii) Phosphating the surface by applying phosphating jelly to obtain a conversion coating in about 45-60 min., followed by a brush coating of inhibitor solution; (iii) Application of two coats of inhibited cement slurry by brushing at 12-24h interval; and (iv) Sealing the cement coat against ingress of salts by brushing with a sealing solution.

The entire process takes about three days, and a chloride-free protective environment is provided around steel bars.

The capital investment required for a minimum economic unit (600 tonnes/annum) is Rs 7.62 lakh, and cost of production works out to Rs 6.6 lakh. Return on capital is expected to be 30%.

The process has already been released to four firms in Madras, Calcutta and Bombay for commercial production. In addition, the know-how is being utilized in Pamban Bridge Project, and by the Cochin Port Trust, Maharashtra Sewerage Board, National Highways Division III (Thane), and Bridges and Building Circle (Rajkot), for captive use.

The terms and conditions for release of know-how are — lumpsum premium: Rs one lakh, Recurring royalty: nil, Nature of licence : non-exclusive, and Period of licence : 10 years. Further details regarding the process can be had from: The Managing Director, NRDC, 20-22 Zamroodpur Community Centre, Kailash Colony Extension, New Delhi 110048.

Pneumatic Transportation of Solids

Pneumatic pipeline conveyors are used for transporting particles of solid materials to remote plant areas which would be hard to reach economically with mechanical conveyors. The pipeline conveying system has many distinct advantages over other modes of transportation, e.g. saving of space, minimum maintenance cost, no wastage/spillage of material and pollution-free surroundings.

The Regional Research Laboratory (RRL), Bhubaneswar, has built up expertise for dry grinding of coal to the desired particle size and has pneumatic test rigs for different pressure systems. The laboratory is actively engaged in studying the transportation of coal from the stock yard to Stage-II bunkers at a distance of 250m at the Talcher Thermal Power Station. Highlighting the RRL's studies, Shri Sudipta Das, Scientist, Design & Project Engineering Division of the laboratory presented a paper at the National Seminar on Pneumatic Transport System, organized by the Institution of Engineers (India), Pune.

o o o

Down Draft Technique for making Portland Cement

Regional Research Laboratory (RRL), Bhubaneswar, has developed a down draft technique, using solid fuel waste as source of heat, to produce portland cement grade clinker. Use of solid waste fuel along with the raw material charge, high productivity of the down draft system, low retention time and simplicity of the system used, make the process techno-economically highly attractive even on small and medium scales. The estimated cost of production of cement on a scale of 25 tonnes/day works out to around Rs 900/tonne.

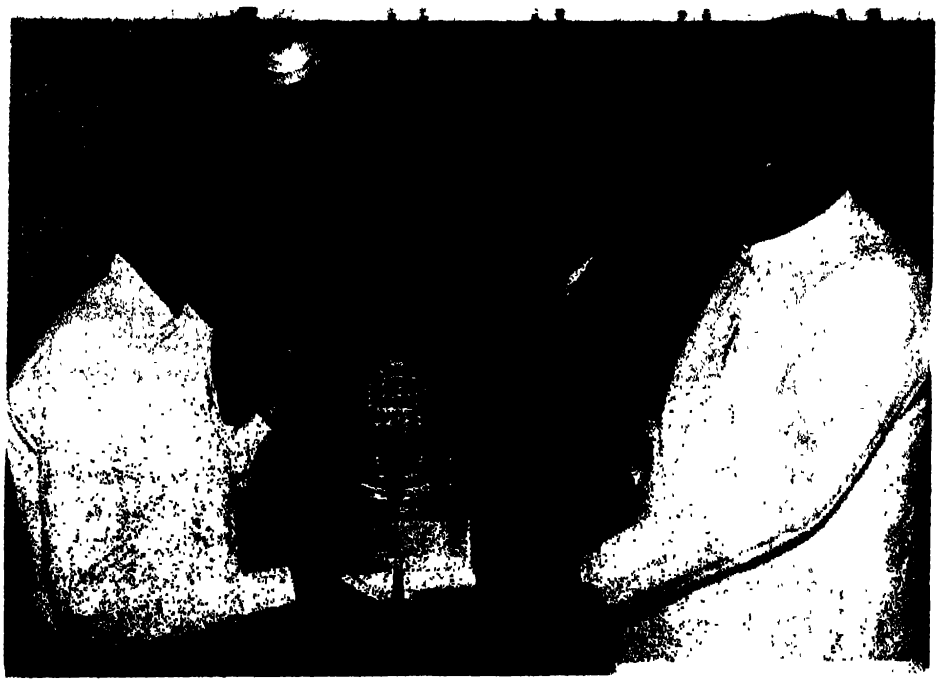
Two Andhra Pradesh Industrial Units utilizing CSIR Technologies win FAPCCI Awards

The Federation of Andhra Pradesh Chambers of Commerce and Industry (FAPCCI) has been presenting, since 1974, annual awards to industrial organizations in the state, in recognition of their outstanding achievements in diverse fields. Of the nine awards presented for 1989-90, two were for 'Best Technological Development in R&D and Commercial Production of New Product for the first time in Andhra Pradesh', and these were presented to the Hindustan Polymers and Southern Magnesium and Chemicals.

The Hindustan Polymers, a unit of the UB group, alongwith the National Chemical Laboratory (NCL), Pune, developed Albene process for the manufacture of ethylbenzene from alcohol and benzene using a zeolite catalyst in a single step against the conventional two-step process [*CSIR News*, 40(1990),62].

The Southern Magnesium and Chemicals Limited produced magnesium metal on a commercial scale for the first time in India, essentially based on the National Metallurgical Laboratory, Jamshedpur's demonstration plant (200 tonnes/day), which the firm acquired through purchase. The entire plant was dismantled, modified and set up afresh at Kovvur in West Godavari District, with upgraded capacity (600 tonnes/annum). It is in commercial production since March 1990.

The awards were presented by the Andhra Pradesh Chief Minister Dr M. Chenna Reddy, at the 73rd Annual Function of FAPCCI held in Hyderabad on 18 September 1990.



Shri N. Ravi Prasad, Managing Director, Southern Magnesium & Chemicals Ltd, receiving the FAPCCI Award from Chief Minister of Andhra Pradesh, Dr M Chenna Reddy

ITRC Mobile Laboratory Vans for Water Quality Analysis presented to Users

On the request of the National Mission on Drinking Water, Department of Rural Development, Ministry of Agriculture, Government of India, and as a part of the commitment of CSIR under the 35 Point Action Plan, the Industrial Toxicology Research Centre (ITRC), Lucknow, has designed and developed 17 mobile laboratory vans for water quality analysis and water pollution abatement studies. The presentation ceremony of these mobile laboratory vans to various regional centres of the National Drinking Water Mission was held on 17 August 1990.

Speaking on the occasion, Shri Upendra Nath Verma, the then Minister of State for Rural Development, Ministry of Agriculture, said that the drinking water problem was likely to be solved within two years. The Union Government, in coordination with the state governments and help of ITRC/CSIR was making concerted efforts and had approved Rs 100 million to solve the drinking water problem in the country. He commended the work of ITRC towards developing the mobile vans and portable kits for water quality analysis.

Smt. Sukhda Misra, Minister

Shri Upendra Nath Verma, the then State Minister for Rural Development, flagging off the mobile laboratory vans

for Rural Development and Panchayat Raj, Uttar Pradesh Government, presided over the function. In her address, she said that the mobile laboratories would provide the latest methodologies and facilities in the rural parts of the country to ensure the quality of the drinking water.

Lauding the contributions made by ITRC, Smt. Misra called upon the Union Government to enunciate more projects on potable water for U.P. as the state had big reserves of water. Launching of such projects, she said, would ensure the availability of potable water to the remotest villages of the state.

Dr P.K. Ray, Director, ITRC, in his welcome address highlighted the activities of his laboratory towards the Drinking Water Mission. Regarding the mobile water analysis laboratory he said that it would meet the immediate needs of water quality analysis and help the government in covering an extensive area within a short time. The technology of the mobile laboratory van had been transferred by ITRC through a memorandum of understanding to M/s Jain Scientific Glass Works, Ambala Cantt.

The vans were handed over to the users from Gujarat, Himachal Pradesh, Uttar Pradesh, West Zone Regional Centre (Jodhpur), North Zone Regional Centre (Lucknow), and Delhi by Shri Verma who also awarded mementoes and certificates to the scientists and other staff of ITRC who had significantly contributed to the successful development of the mobile laboratory van. Smt. Misra presented the ITRC portable water analysis kits to the recipients of the mobile laboratory vans.

Know-how for production of ITRC water analysis kits transfered to a third entrepreneur

The portable water analysis kit, developed by the Industrial Toxicology Research Centre (ITRC), Lucknow, permits foolproof physico-chemical and biological tests necessary to ensure supply of safe drinking water. The kit had been approved by the Water Mission Directorate of the Ministry of Rural Development, and the know-how for the kit transferred to two parties.

Recently, the know-how has been transferred to another entrepreneur, M/s Mathbin Scientifics, New Delhi, who will be manufacturing these kits for the eastern parts of the country. Also, the entrepreneur has letters of intents from Malaysia, Indonesia, Bangladesh, Nepal and one African country and also an order from UNESCO.

Studies in the Chemistry of Conjugated Acetylenic Nitriles

Propynenitrile, is the parent compound in the series of conjugated acetylenic nitriles. The carbon-carbon triple bond which is activated by conjugation with the nitrile function offers immense scope for cyclo addition and nucleophilic addition reactions. Shri Hafeez-ur-Rehman of the Indian Institute of Chemical Technology (IICT), Hyderabad, carried out studies on the preparation of substituted propynenitriles and their application in the synthesis of some heterocycles.

The synthesis of oxo-substituted phosphorus ylides was carried out starting from triphenylphosphine, chloroacetonitrile and a carboxylic acid chloride. The oxo function is derived from phenoxyacetic acid or 2-methyl-2-phenoxy-propionic acid and derivatives containing a methyl or chloro or methoxy group in *ortho* or *para* position of phenyl ring. In the case of phenoxyacetyl chloride and its derivatives, the transylidation method was used to prepare the oxo-ylides. In the 2-methyl-2-phenoxy-propionyl chloride the

use of external base replaces the transcylidation step.

The thermolysis of oxo-ylides leads to the discovery of new reaction termed as Tandem Intramolecular Wittig and Claisen rearrangement reaction. Using this new reaction, some benzofuran and 2H-chromene derivatives were synthesized. The results provided evidence for the occurrence of 3,3-sigmatropic reaction and the intermediacy of allenyl substituted cyclohexadienones in the rearrangement of cyanopropargyl aryl ethers.

The studies carried out on the cyclo addition reactions of some 1-methyl-2(1H)-pyridinones with substituted propynenitriles gave an insight into the aromatic character of the pyridone and also to the synthesis of novel N-substituted pyridones by the reaction of 2(1H)-pyridinone or its methyl derivatives with substituted propynenitriles.

Shri Rehman was awarded Ph.D. degree by the University of Roorkee for his thesis based on the above studies. He carried out the above work under the guidance of Dr J. Madhusudhan Rao of Organic Chemistry-II Division of IICT.

Prof. G. Vetter visits IICT, Hyderabad

Prof. G. Vetter, Head, Institute of Apparatus and Chemical Machinery, University of Erlangen, FRG, visited the Indian Institute of Chemical Technology (IICT), Hyderabad, during 9-10 August 1990. Prof. Vetter is the former Technical Managing Director of Lewa Pumps, known world over for metering pumps and systems.

During his visit, Prof. Vetter delivered two lectures: (i) Trends of the technical and scientific development in bulk solids metering, and (ii) The design of screw feeders and differential scales for bulk solids metering under the aspects of particle mechanics.

A joint collaborative programme of work between Design and Engineering Division, IICT, College of Technology, Osmania University and Prof. Vetter covers: Investigation on the effect of operating parameters on cavitation, valve and piston wear, pressure pulsation and vibration, materials of construction, etc. of reciprocating pumping systems; Setting up of fully instrumented test rigs for performance evaluation of fluid and solid metering and dosing system; Design and development of pulsation dampers for reciprocating fluid pumping systems.

TRAINING COURSES

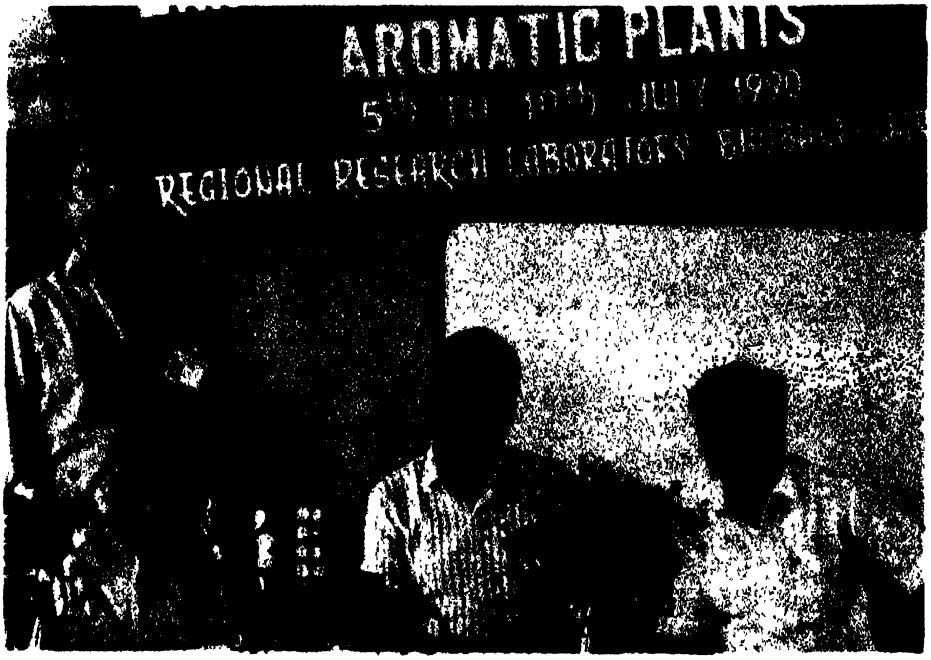
Training Course on Large Scale Cultivation and Distillation of Aromatic Plants

The Regional Research Laboratory (RRL), Bhubaneswar, organized a training course on Large Scale Cultivation and Distillation of Aromatic Plants, during 5-10 July 1990 Thirty participants representing teachers, students, businessmen, industrialists, entrepreneurs and candidates sponsored by the state government departments, universities and voluntary organizations attended the course. This course was organized mainly to train trainers for popularizing large scale cultivation of aromatic plants under the action plan 'Training of Trainers for a variety of Vocational Trades in Rural Areas' of CSIR.

The course comprised lectures and field demonstrations on various aspects of cultivation practices from nursery sowing to harvesting, distillation, packing, storing, quality evaluation and marketing of palmarosa, lemongrass and citronella, the three most promising crops of aromatic plants of the Orissa region.

Training in dBaseIII Plus

The Library and Information Sciences Division of the Central Electrochemical Research Institute (CECRI), Karaikudi, conducted an in-house computer training programme on 'Fundamentals of



Prof. H.S. Ray, Director, RRL-Bhubaneswar, addressing the participants of the training course for cultivation of aromatic plants Seated on the dais (from left) are: Dr Amber Ghosh, Senior Project Officer, British Council Division, Calcutta and Dr H.O Saxena

dBaseIII Plus' for the institute staff. Twenty-five participants belonging to the scientific, technical and administrative cadres attended this course. The course was conducted in batches (5 days for reach batch) during June/July 1990 and it comprised theoretical classes and practical hands-on training.

The programme was intended to create an awareness among the staff on the capability of dBaseIII Plus for database management and it covered file creation, file maintenance, file organization, retrieval, output formats using report and label form, etc.

CONFERENCE BRIEFS

Second International Conference on Trace Metals in the Aquatic Environment

Dr Prakash Chandra of the National Botanical Research Institute, Lucknow, attended the second International Conference on Trace Metals in the Aquatic Environment from 9 to 14 July 1990 at the University of Technology, Sydney, Australia. Delegates from 28 countries participated in the conference and presented papers related to toxicity and bioaccumulation, metals in sediments, environmental impacts of monitoring, etc. Dr Chandra presented a paper entitled Absorption and toxicity of chromium and cadmium in *Limnanthemum cristatum* Griseb.

DEPUTATION BRIEFS

Dr A.A.Khan

Dr A.A.Khan, Deputy Director and Head, Chemical Engineering Division, Indian Institute of Chemical Technology, Hyderabad, was invited by the Commonwealth Science Council to participate as resource person, in Project Planning Meeting held at Gaborone, Botswana, from 30 May to 1 June 1990. The meeting reviewed the status of capabilities in the area of process design and engineering and the demand for design and engineering (D&E) services in the region. Presentations were made by participants from UK, India and Kenya on the role of D&E in development and transfer of technologies, training needs, quality assurance component of D&E, and significant achievements recorded in India as a result of this expertise. The meeting recommended establishment of a focal point in the region with a view to conducting detailed survey of the demand and opportunities as well as to act as the nucleus for a future D&E Centre.

Dr R.A. Mashelkar

Dr R.A. Mashelkar, Director, National Chemical Laboratory (NCL), Pune, was deputed to Mexico and USA for 17 days from 28 June 1990 for attending a Workshop on Heat Pumps in Mexico, and visiting leading industries in USA, particularly those concerned with catalysts and catalytic reactions and polymer sciences to study the latest developments in these areas and explore possibilities of collaboration including technology transfer of NCL products.

Dr P. Ratnasamy

Dr P. Ratnasamy, Deputy Director, NCL, Pune, was deputed to Japan from 26 June to 5 July 1990 to deliver lectures in the first international symposium on the Chemistry of Microporous Crystals and to attend the conference on Advanced Catalytic Science and Technology.

Dr S. Sivaram

Dr S. Sivaram, Head, Polymer Chemistry Division, NCL, Pune, was deputed to Italy, USA and Japan for 12 days from 13 June 1990 to evaluate and assist in the project: Alpha-olefins for IPCL's Gandhar Complex.

Dr A.F. Mascarenhas

Dr A.F. Mascarenhas and Dr (Ms) R.S. Nadgauda, Scientists, Division of Biochemical Sciences, NCL, Pune, were deputed to the Netherland for attending VIIth International Congress on Plant Tissue and Cell Culture, in Amsterdam from 24 to 29 June 1990.

Dr P.K. Ranjekar

Dr P.K. Ranjekar, Scientist, Division of Biochemical Sciences, NCL, Pune, was deputed to USA for three months from 19 June 1990 to take up Biotechnology Overseas Associateship. (short-term) 1989-90 at the Cornell University.

ANNOUNCEMENTS

Third International Symposium on Beneficiation and Agglomeration

The Third International Symposium on Beneficiation and Agglomeration is being organized by the Regional Research Laboratory (RRL), Bhubaneswar and the Indian Institute of Metals (Bhubaneswar Chapter), at RRL during 16-18 January 1991. The aim of the symposium is to provide a forum for discussion and exchange of experience in the field of utilization of mineral resources. The technical programme comprises presentation of papers on different aspects of beneficiation, agglomeration and reduction of ores and minerals, by experts from different parts of the world.

Further details regarding the symposium can be had from: Shri D.N. Dey, Convener, ISBA-91, RRL-Bhubaneswar 751013.

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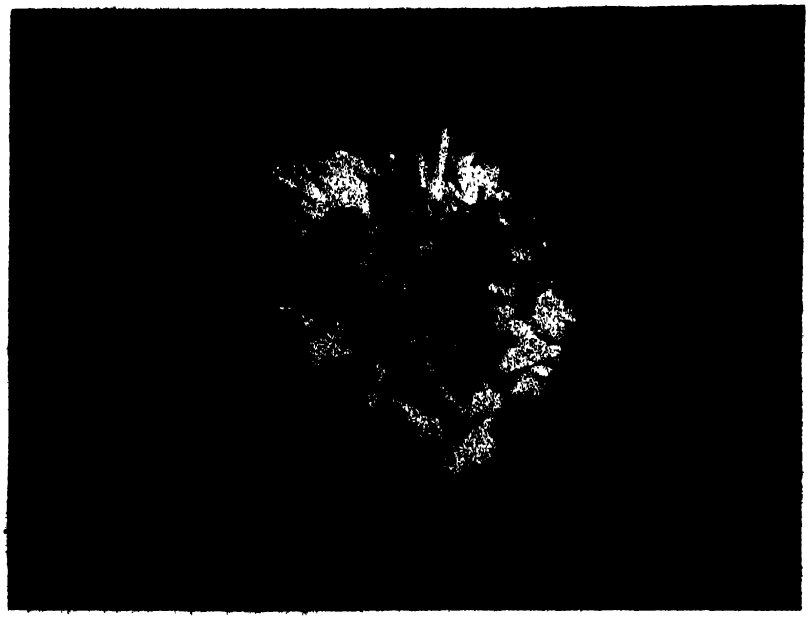


CSIR Complex, Palampur, made significant contributions, during 1988-89, in the areas of tea plantation, floriculture and post harvest fruit handling (p257). Shown here are (clockwise from top left): *Rosa damascena*, *Tulipa* sp, and Perennial carnation C.V. Sam's Pride grown under Palampur conditions following the agrotechniques standardized by the laboratory.

Spectral Shift during Propagation of Radiation and Its Implications in Optical Measurements

DR K.C. JOSHI
Optical Radiation Standards Group, National Physical Laboratory, New Delhi

It has been a long belief that thermal sources are totally incoherent and their spectra remain invariant during propagation in free space. In recent times, however, it has been established that these sources do possess some temporal and spatial coherence within the limits of the average wavelengths emitted by them. This coherence property of source correlation when described in terms of position and frequency dependent distribution functions and field correlation, provides a deeper insight into many physical phenomena, e.g. light scattering involving density fluctuations in substances, radiometry with sources of any state of coherence, etc. The field correlation is measured in terms of complex degree of spectral coherence [L.Mandel and E.Wolf, *J.Opt.Soc.Am.* A 66, 529 (1976)]. In general, the complex degree of spectral coherence of an incoherent source depends on the wavelength through a variable $k(\vec{r}_2-\vec{r}_1)$, where $\vec{r}_2-\vec{r}_1$ denotes the vectorial distance between two source points and $k=2\pi/\lambda$. This is called the scaling law [E.Wolf, *Phys. Rev. Lett.* 56, 1370 (1986)]. If the source obeys the scaling law, its normalized spectrum and the normalized spectrum of the field in the far zone are the same. On the other hand, if the scaling law is violated, i.e. if the degree of spectral coherence becomes independent of k, the spectrum of the radiation detected at a distance away from the source gets spectrally redistributed due to source correlation and results in a shift with respect to the spectrum measured at the source. This was predicted theoretically by Wolf [E.Wolf, *Nature*, 326, 363 (1987) and *Optics Commun.* 62, 12 (1987)]. Though the above prediction was verified experimentally by M.Morris and D.Faklis [*Optics Commun.* 62, 5, 1987; *Optics Letts.* 13, 4 (1988)], their experimental set-up was complicated, and has been seldom used in actual measurements. Therefore, the far reaching implications of this phenomenon could not be perceived.

The Optical Radiation Standards Group of the National Physical Laboratory, New Delhi, has demonstrated this important phenomenon with a simple experimental set-up (Fig.1), which is close to the one often encountered in optical measurements. This has made it easy to visualize the implications of the discovery and has opened many vistas of research (H.C. Kandpal, J.S. Vaishya and K.C. Joshi, *Phys. Rev.* A 41, 4541 (1990)].

For the first time, the NPL group has shown that the frequency spectrum of the secondary source generated by using a lens or a mirror focussing optics changes during propagation due to source correlation. This observation has been recently given theoretical support by Foley [J.T.Foley, *Optics Commun.* 75, 347 (1990)].

The phenomenon of spectral shift during propagation of radiation is very relevant in all optical measurements and strongly suggests that the entire procedure in optical measurements, hitherto followed, should be re-examined. Uptill now, wavelength shift due to source correlation was not known and hence was not being taken into account in these measurements. The contribution of source correlation is bound to influence the measurements by varying amounts depending upon the experimental schemes used.

One of the significant examples of the effect of source correlation, as pointed out by the NPL scientists, is its influence in the field of spectroradiometry [H.C. Kandpal, J.S. Vaishya and K.C. Joshi, *Optics Commun*, 73, 169(1989)]. Every country maintains its own standards of spectral radiance and spectral irradiance for which the spectral power is required to be measured to a high degree of precision. These standards are intercompared periodically. The intercomparison of spectroradiometric scales maintained by different national laboratories showed a difference of about ± 5% (Fig. 2). The scatter was attributed to the nonlinearity of detectors, polarization and temperature effects, variation in the size of the slits used to maintain constancy of band width, etc. But these known sources of errors could not properly account for the observed large scatter. The NPL group has now suggested that the phenomenon of spectral shift due to source correlation may be responsible for causing such a large scatter.

It is estimated that the conventional spectroradiometric set-ups could cause a spectral shift of 1nm due to source correlation (Fig. 3). This shift would result in 1.5% variation in the measured spectral power at 540 nm and a change of 3% at 400nm, and would introduce measurement errors depending on the actual optical systems used. The above observations may serve as a guideline for future intercomparison of photometric and radiometric scales and may enable the national laboratories to narrow

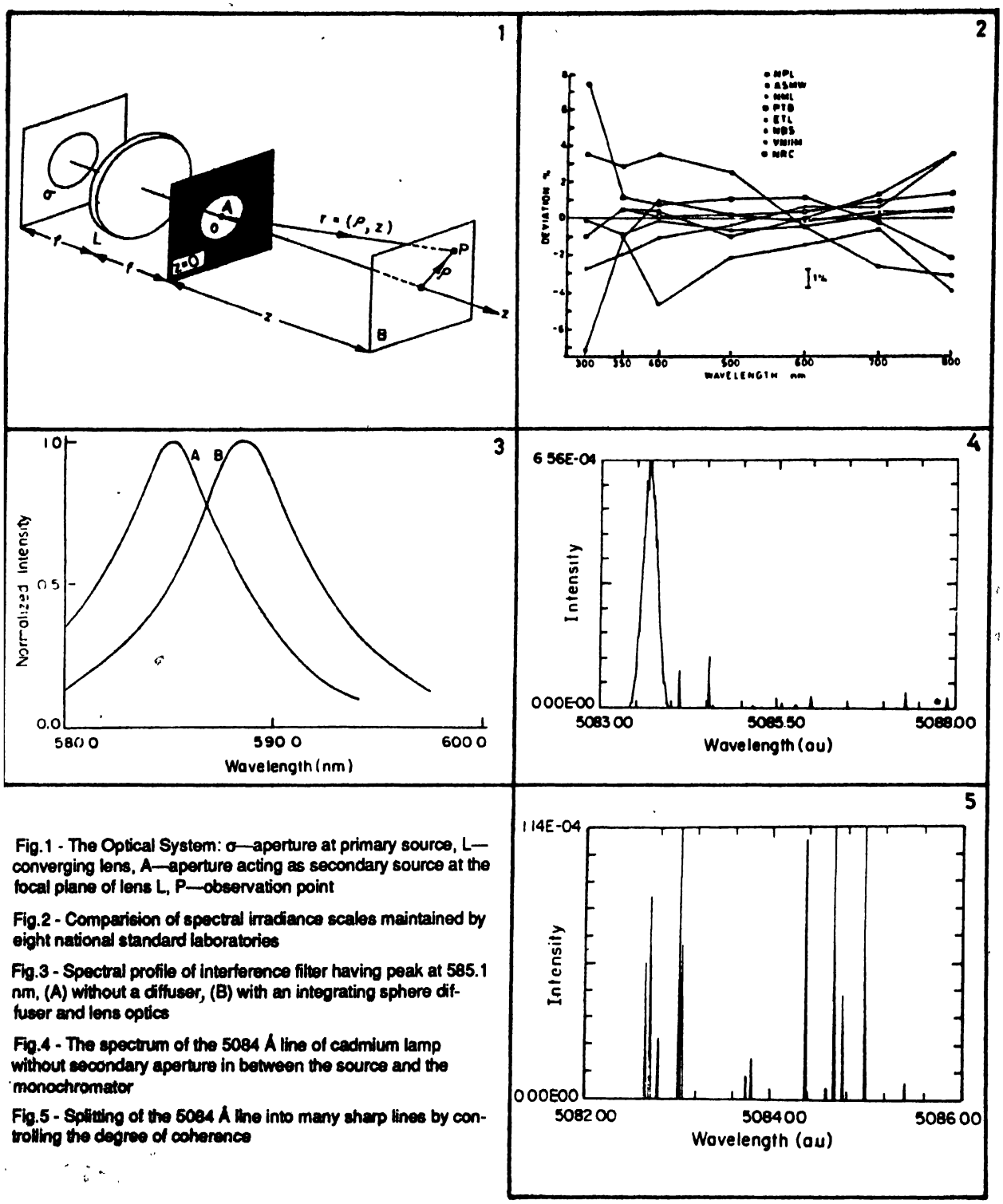


Fig.1 - The Optical System: σ—aperture at primary source, L—converging lens, A—aperture acting as secondary source at the focal plane of lens L, P—observation point

Fig.2 - Comparision of spectral irradiance scales maintained by eight national standard laboratories

Fig.3 - Spectral profile of interference filter having peak at 585.1 nm, (A) without a diffuser, (B) with an integrating sphere diffuser and lens optics

Fig.4 - The spectrum of the 5084 Å line of cadmium lamp without secondary aperture in between the source and the monochromator

Fig.5 - Splitting of the 5084 Å line into many sharp lines by controlling the degree of coherence

down the large difference in their reference scales.

The influence of source correlation in spectroscopic measurements has also been investigated at NPL [H.C. Kandpal, J.S. Vaishya and K.C. Joshi, *Optics Commun*, 79, 270(1990)]. The radiations emitted by the ions doped in crystals show certain amount of spectral shift from their true (original) spectra. Such shifts which were earlier attributed to the crystal field, phonon interaction, etc. would require further inves-

tigation in the light of the new findings and may eventually help in proper understanding of many non-radiative processes responsible for intramolecular and intermolecular energy transfer processes.

Recent theoretical investigations [A. Gamliel and E.Wolf, *Optics Commun.* 65, 91 (1988)] have shown that under certain controlled conditions of source correlation, it is possible to generate several lines from a single spectral line having Lorentzian profile. NPL has taken a lead in experimentally varifying this very important phenomenon by controlling the degree of spectral coherence at the secondary source [H.C. Kandpal, J.S. Vaishya and K.C. Joshi, *Optics Commun.* 77, 1(1990)]. Fig.4 shows the original spectrum of 5084 Å line of cadmium having half width of 0.5 Å. Fig.5 shows the spectrum of this line after controlling the degree of coherence. This phenomenon may have potential applications in communication systems for coding and decoding of signals, etc. and may explain the origin and existence of many lines in solar spectrum which have hitherto posed problems to astrophysicists.

In conclusion, it can be said that the discovery of spectral shift due to partial coherence of a source has introduced radically new concepts in the domain of optical measurements and may offer solution to many inconsistencies hitherto unexplained in optical, astronomical and spectroscopic measurements. As the phenomenon is associated with the wave nature of electromagnetic radiation, it may have far reaching effects in the entire range of the electromagnetic spectrum.

Genetically Superior Artificial Autotetraploids established in Indian Henbane

Tropane alkaloids are medicinally important secondary metabolites having anticholinergic, antiemetic and parasympatholytic actions. The current world demand of tropane alkaloids has been estimated to be $ 100 million per year, and the international price for the various tropane alkaloids (hyoscyamine, scopolamine and the related alkaloids) vary from $ 350 to 1400 per kg. Although, chemical synthesis of hyoscyamine and scopolamine has been achieved, it has not been found economical. Hence, these alkaloids are obtained from plants. The above ground plant parts constituting the herbage in the various species of Hyoscyamus are valuable source for the extraction of these alkaloids. However, the different species support varying ecological requirements and produce varying profile of tropane alkaloids. Of the three species of Hyoscyamus occurring in India, H. niger could be cultivated under subtropical and temperate regions. This species is a better source of the more important scopolamine. Dried leaves and flowering tops of this plant are also smoked in the form of cigarette for relieving the irritable conditions of asthma and whooping cough.

Artificial polyploidy generally leads to enhanced vegetative vigour and enzyme activity, and as such may be favourable where biomass and its associated metabolites constitute the economic product. Therefore, as a rapid approach to genetic improvement of Indian henbane, polyploidy breeding was resorted to at the Central Institute of Medicinal and Aromatic Plants, Lucknow. Consequently, genetically stable artificial autotetraploids with over 90% seed set have been realized in this medicinally important solanaceous species. The tetraploids are vigorous for various morphological characters except plant height and are capable of yielding 22.5% more alkaloids than the parental diploids. This is attained by 4.8% increase in dry matter production and 16.7% increase in alkaloid content. The average alkaloid content in the dry matter was found to be 0.26% in the tetraploid as against 0.22% in the diploid. The performance data recorded over generations revealed that the tetraploids have the potential of producing 6 kg of crude alkaloid and 24 quintals of dry matter per hectare from a crop of 100 days standing.

One of the most important features of these tetraploids is their very high seed set, which is very rare in artificial autotetraploids. This is quite essential for conferring genetic stability. The raw tetraploids possessing more than 75% seed set were isolated and advanced to further generations following rigid selection for vigour and fertility leading to the establishment of the instant tetraploid stock. At cellular level, the high fertility in the tetraploid could be correlated to the formation of genetically balanced gametes accruing from high bivalent frequencies.

Technology for Fractionation of Dementholized Oil

Dementholized oil (DMO) is a low value byproduct resulting from the chilling at low temperature of Mentha arvensis oil for making natural menthol crystals. The DMO so obtained cannot be utilized for flavouring and perfumery because of poor odour quality owing to the

presence of monoterpenes and menthone. The approximate composition of major constituents of DMO is as follows: monoterpenes — 10-12%, menthone — 25-30%, menthyl acetate — 5-8% and menthol — 35-45%. A large quantity of DMO (approx. 400-500 tonnes/annum) is available in the market at cheap price.

In order to achieve better utilization of DMO, the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, has developed a technology to fractionate DMO into following fractions in a high vacuum column: (a) Liquid menthol (minimum 90% menthol content), (b) Menthone (minimum 90% purity), and (c) Byproduct terpenes mixture.

Liquid menthol fraction has a sweet peppermint flavour which has been found to be very useful for flavouring toothpastes and confectionary and has good market demand in India. Menthone of 90% purity is a useful aroma chemical having a good export market. It is also used for the manufacture of other perfumery compounds. Mentha terpenes also have a ready export market.

Workshop on New Horizons in Rural Development: Strategy for Growth

The Central Electronics Engineering Research Institute (CEERI), Pilani, in collaboration with the Department of Science & Technology, Government of Rajasthan, NAFEN, New Delhi and Goshala, Pilani, organized a workshop on New Horizons in Rural Development: Strategy for Growth, on 17-18 August 1990, as a part of Dr Ambedkar's Birth Centenary Year celebrations.

The factors which limit the application of S&T for rural needs are not only cost and complexity but also social and cultural. Therefore, it is necessary to take a broader perspective of S&T needs and their effective fulfilment through proper organization and administrative linkages amongst local, state and central government agencies. It was in this context that CEERI had organized the previous two workshops. The main objective of the present workshop, third in the series, was to plan, with the help of Goshala, field trials of equipment being developed for application in rural areas, and to assess the progress already made in this direction. The workshop was also intended to discuss the efforts being made concerning the establishment of a 'Rural Technology Demonstration Centre' at Goshala, where all relevant rural technologies would be demonstrated.

The workshop focussed on: Rural Development: Conceptual Issues in Indian Profile; Industrial and Rural Development; Science, Technology & Society; Women, Education & Rural Development; and Public Health & Rural Development. Panel discussion was held to prepare an action plan for development in rural profile. A technical exhibition was also held on the focal theme of the workshop, with active collaboration of the Birla Museum, Pilani.

Dr R.K. Iyengar, Additional Director General, CSIR, was the chief guest on the occasion and delivered the inaugural address. Shri Motilal Dalmia, Industrialist, Bombay, presided over the function; Dr I.P. Shah, Dairy Technology Expert, presented the keynote address, and Dr W.S. Khokle, Director, CEERI, welcomed the participants. Thirty-five delegates participated in the workshop and eight teams took part in the exhibition.

Dr Iyengar in his address said that developmental schemes should not be just planned and discussed; they should actually be delivered door to door. CSIR, he said, had developed several technologies for the benefit of the rural masses and was on the lookout for organizations which could aid in the deliverance of these technologies to the right and needy groups.

Delivering the keynote address, Dr Shah highlighted the future of dairying in India. The universal use of milk, the nature's most balanced food, has led to the setting up of organized dairies. Dr Kurian, who started 'AMUL' in Anand has done revolutionary work towards establishment of milk cooperatives in the country. But the problems in the area of dairying are too many. India has 16% crossbred animals; the rest 84% are nondescript. Since crossbred animals yield double the quantity of milk, there is a pressing need for crossbreds to fill the demand supply gap for milk and its products. Also, the importance of buffaloes is diminishing.

Biotechnology can come as an aid to solve the above problems. Work has already begun in the field of breeding, nutrition and feed. Research on cows as a producer of drugs, transgenesis and nano technology is also underway, Dr Shah added.

Panel Discussion

The technical sessions were followed by a panel discussion to review ideas and suggestions put forward during the two-day tenure of the workshop and to prepare an action plan for the future.

Dr Khokle initiated the discussion. Referring to the proposal made in previous year regarding the establishment of a 'Rural Technology Demonstration Centre', Dr Khokle informed that a grant of Rs 1 lakh was likely to be sanctioned by DST, Government of Rajasthan, this year. He also highlighted the efforts made towards increasing

the milking capacity of the cows at the Goshala.

Dr Shah promised to supply all valuable information related to the dairy technology.

Shri Dalmia opined that as a long term plan, Pilani should have an agricultural college, a dairy development institute and a social forestry organization. As a short term measure, he said, organic composite manure should be produced at the Goshala and marketed all over the country.

He said that it had not been decided as to which variety should be chosen for hybridization. The possibility, however, revolved around a variety called 'Ciyas' found in the Himalayan region. These cows weigh just 250-300 kg and give much more milk compared to the fodder they eat.

Speaking on the subject of 'Project Failures', Shri M.P. Bhomia said that combating project failures was equally essential as setting up of new projects. Some problems mentioned by him were: receding water levels in the tubewells, motor failures due to fluctuations in the voltage, non-availability of good variety seeds and irrigation facilities. He suggested that techniques like usage of hollow bamboo for irrigation, planting of 'saboodana', etc. should be taken up.

Shri M.P. Dixit, Project Director, DST, Rajasthan, assured all assistance from his department in the rural development. Stating that the departments of Agriculture, Dairy and Forestry, also had developmental projects to be implemented by voluntary organizations, he suggested that CEERI/Goshala should approach these departments, and the development officers from District Jhunjhunu should also be involved.

Ms Reena Chadha, Lecturer, I.M. Home Science College, Pilani, opined that Home Science can be a powerful media for rural development. Home development will pave way for community development. Women can be given quality based home science education and made competent to play their rightful role in overall growth, she added.

Dr P.K. Sehgal, CMO, M.S. Eye Hospital, spoke on the role of medicine in the process of the rural development. According to the latest statistics, Dr Sehgal informed that about 11 million people were getting blind owing to cataract alone every year, and there were only about 6000 ophthalmologists available. He offered to hold medical camps in Pilani and nearby areas every fortnight, provided he was given assistance in the form of manpower, active participation of rural masses and adequate publicity. Dr K.R. Chandoke, NSS Coordinator, BITS, offered to make available his volunteers for this purpose.

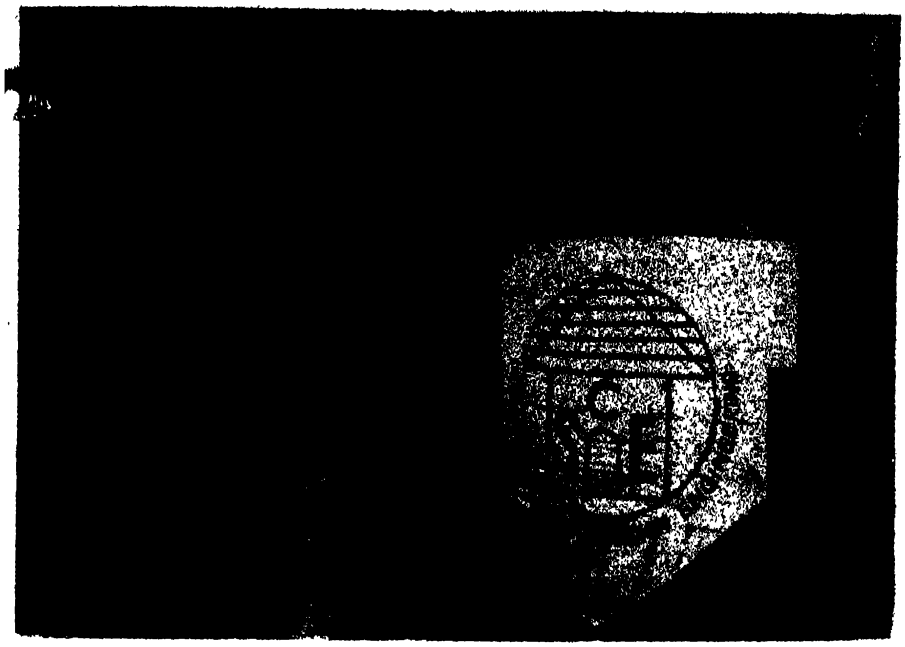
Prof. L.K. Maheshwari, Dean, R&C Division, BITS, was of the opinion that education should be firmly linked to the environmental activities. He suggested that the student community at BITS could be involved in the developmental activities undertaken by CEERI/Goshala. Besides this, he also offered to start apprentice courses for school dropouts and other lesser educated lot for their upliftment.

Seminar on Standards in Construction Engineering

A national seminar on 'Standards in Construction Engineering' was organized at the Regional Research Laboratory (RRL), Bhopal, during 3-4 August 1990. The seminar was jointly organized by RRL(Bhopal) and Institute of Standards Engineers(Bhopal), with the cosponsorship of Madhya Pradesh Council of Science & Technology (Bhopal), Central Public Works Department (CPWD), New Delhi, and Central Building Research Institute, Roorkee. Over 150 delegates from various organizations, e.g. Government of M.P., national laboratories, research organizations, CPWD, M.P. PWD, CPA(Bhopal), BDA(Bhopal), M.P. Housing Board, Regional Engineering Service (Bhopal) and HUDCO attended the seminar. Shri S.K. Sharma, Chairman and Managing Director, Housing and Urban Development Corporation, New Delhi, inaugurated the seminar and Lt. Gen. A.S. Bhuller, President, SEI and DG (Quality Assurance), Ministry of Defence, was the Chief Guest. Prof. T.C. Rao, Director, RRL, Bhopal, welcomed the participants. Shri A.C. Khazanchi, Programme Secretary, conducted the proceedings and gave a vote of thanks.

Expressing his concern over the view being expressed throughout the country regarding the deteriorating standard in construction engineering, Shri Sharma said that a Building and Construction Material Council formed recently by the Ministry of Urban Development would start working shortly. He further added that national housing policy is being evolved to cope with the increasing human settlement problem in the country with a large part of its population living in slums. Stressing the need for use of alternative and cheaper construction materials, he cautioned that such materials should be pretested before actual use.

In his keynote address, Lt. Gen. Bhuller said that standardization has vital role to play in design and manufacture of the construction materials. He suggested that the standards available should be reviewed constantly to align with the developing technology. He also stressed the significance of safety



.t. Gen. Bhuller delivering the keynote address. Seated on the dais (from left) are: Prof. T.C. Rao, Dr D.N. Mishra, Shri S.K. Sharma and Shri S.K. Handa

measures in the construction engineering.

Speaking on the occasion, Dr D.N. Mishra, Director General, MP Council of Science and Technology, Bhopal, suggested that builders and contractors should make use of the indigenous technology.

Of the two sessions held on the first day, the first session was on 'standardization(Chairmen: Dr Mishra and Shri V.S. Mathur) and the second on 'fly ash, cement, steel and concrete' (Chairman: Shri Khazanchi, Co-Chairman : Dr Navin Chand). Shri S.P. Tehri spoke on the use of fly ash for the production of cellular blocks while Dr U.C. Kalita expressed his views over standards in ferrocement construction. Shri R. Das Gupta, Shri Umesh Dayal and Shri Manjit Singh also presented their papers.

On the second day, a session was held on 'new materials and transfer of technology' (Chairman: Prof. M.R. Madhav, Co-chairman Dr U.C. Kalita). Dr Madhav spoke on the various new technologies in construction engineering particularly those for constructing pavements and railway tracks. He appealed to the engineers to create a mass awakening regarding the new techniques. Shri V. Suresh spoke on 'Building Centres : An effective back up service for housing delivery'. He stressed the need for creating a mass awareness regarding the new techniques, so that people begin to trust economical and better techniques which have been recently in vogue. He further emphasized the need for the establishment of building material centres in all the districts of the country.

Shri Khazanchi spoke on the development of new building materials at RRL, Bhopal.

The seminar recommended the need for a review of present standards, and pre-certification of new building materials and techniques.

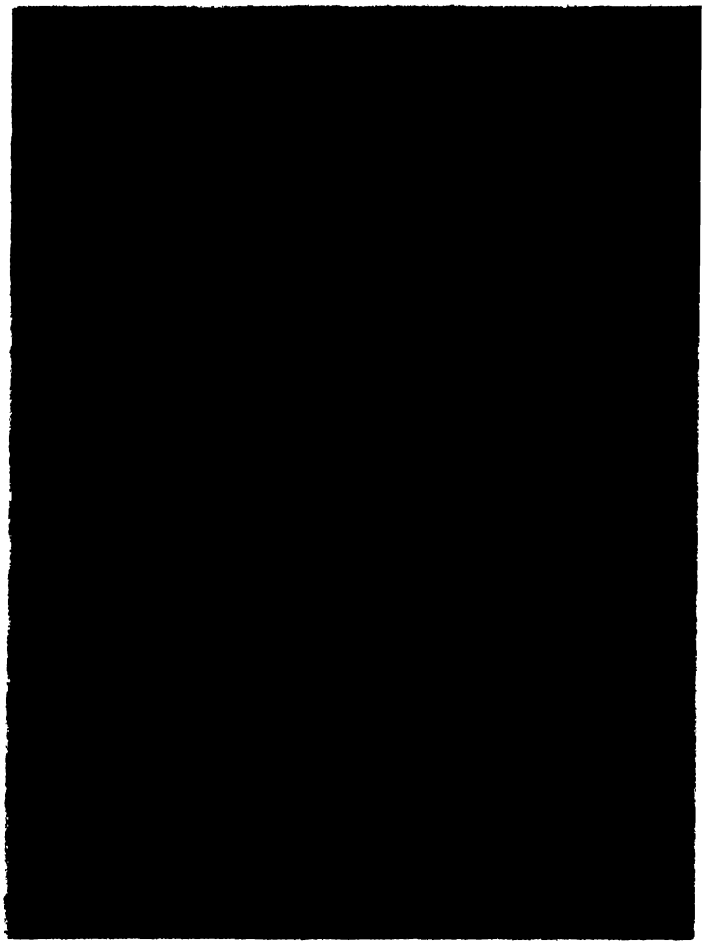
PROGRESS REPORTS

CSIR Complex, Palampur, Annual Report: 1988-89

The CSIR Complex, Palampur, carries out its R&D activities in the following four divisions: Hill area tea science, Floriculture, Post-harvest fruit handling and the 'CSIR Window' division. The laboratory has brought out its annual report for 1988-89, which shows that it recorded an all round progress in its areas of activity. A brief account of its activities/achievements during the period is presented here:

Experiments were continued for standardizing the agrotechniques for tea cultivation under the climatic conditions of Himachal Pradesh. Improved agrotechnology augmented the tea production by ten to thirty times of the yield recorded in 1984. Over the years, many dilapidated tea plantations have been rejuvenated and brought to the limelight through CSIR expertise.

The germplasm collection of tea was enriched and increased to 213 accessions, including two clones from Sri Lanka. A germplasm exploratory trip for collection of seeds and cuttings from Kumaon hills was made jointly with NBPGR. Induction of mutation through gamma irradiation was being attempted. Direct shoot bud generation and spontaneous root formation were achieved in certain media combination from cotyledon and leaf explants of tea, respectively. The results of the plucking studies indicated that standard plucking at an interval equivalent to double the leaf period minus one, may maximize crop production. Pruning in November, at or below ground level, showed numerical superiority four years after the operation. Best performance was recorded from century old plants transplanted in March, with not less than 35 cm root length. In addition to the construction of an LDPE lined water sump, a software was developed for designing irrigation channels. Pesticide residue analysis techniques were developed for eight identified pesticides, in collaboration with the Industrial Toxicology Research



Tea germplasm collection at Talwadi (Kumaon) (left), and Tissue culture raised plants of easter lily growing under outdoor conditions

Centre, Lucknow. More than 90% endosulfan was recovered from treated orthodox and CTC made tea. Baycor proved to be an effective fungicide for blister blight control and black plucking helped in reducing the quantity of fungicide. From the weed control trials, it could be proved that Glyphosate, alone or followed by Paraquat, provides a broad spectrum control of weeds. In the infusion of tea made from different levels of blister infection, all quality parameters like TF, TR and caffeine, were found to drop sharply even at 25% infection.

Biochemical studies on tea showed that the caffeine content increases with the increase in phosphate application from 90 kg/ha to 180 kg/ha, while significant increase in the total infusion colour was noted with the increase in dosage of potash. The polyphenol oxidase activity in the leaves was found to be present mostly during the early flush. The seasonal variation in theaflavin and thearubigin may be due to variation in polyphenol and distribution of PPO and peroxidase in the shoot components.

A highly sensitive silver staining method for detecting proteins on acrylamide gels (tubular) was successfully developed to facilitate the characterization of germplasm samples. An electric tea dryer was fabricated for use in the laboratory.

In the area of Floriculture, assessment of newly imported flowers showed the suitability of many different types of commercially important ornamental plants under Palampur conditions. Trials for standardization of agrotechniques for commercial cultivation of tulip, easter lily, tiger lily, gladiolus, carnation, etc. showed that these plants perform very well under the Palampur conditions and flowers can be produced from April to October i.e. at a time when very little flower grows elsewhere in plains. Tulip from the Netherlands, iris from Poland, seeds of easter lily from Japan and cyclamen from Germany and New Zealand were added to the existing collection of plants. One lowcost polyhouse was constructed using the locally available materials.

The *in vitro* raised easter lily plants exhibited normal flowering under field conditions. Complete direct regeneration of disease- free plants with well developed root system was achieved from bulb scale segments of tiger lilies. To evolve new types as novelty items, stem callusing and later on, successful differentiation of plants was obtained in easter lily. Complete differentiation of plants from leaf and stem segments of four varieties of carnations was accomplished via callus formation. Shoot bud formation and callusing were obtained in case of gladiolus var. Friendship Pink.

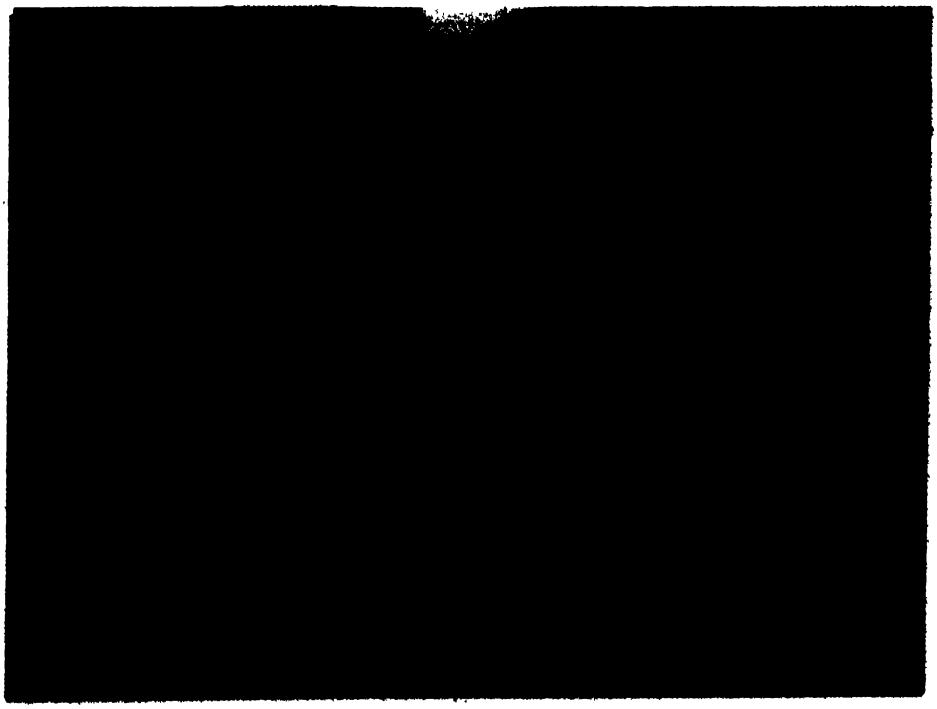
Survey of ornamental plants through immuno-indexing for presence of viruses revealed the presence of cucumber mosaic, lily symptomless and tulip colour breaking viruses from tulip and lily, potato virus from lily and bean yellow mosaic virus from gladiolus. Thermotherapy of bulb scales coupled with *in vitro* culture technique was found to be effective for elimination of cucumber mosaic, lily symptomless and tulip colour breaking viruses from easter lily. Neem oil was found to be very effective for controlling the secondary spreading of viruses.

To have an easy availability of fruits for research purposes, an area of 1.80 acres was planted with different varieties of temperate fruits like peach, plum, apricot and pear; 2500 plants of strawberry were also planted.

Studies on *kinnow* fruit revealed that the fruits should be harvested before second week of January, when the loss of fresh weight is minimum. To prolong the shelf life of *litchi*, alar and cobaltous chloride were found to be very effective. Work was in progress to study the endogenous cytokinins from various parts of *litchi* fruits, the activity of pectin methylesterase (PME) during different stages of fruit ripening and the effect of treatments of certain growth regulators on the enzyme activity of *litchi*. A method to determine PME in ripening fruits of *litchi* was standardized.

The 'CSIR Window' division conducted trials on cultivation and oil quality of *Rosa damascena*. Results indicated that the seven-month old rose plants transplanted in first week of August and given optimum supply of inputs, yield 900kg flowers/ha, having 0.045% of oil content.

White button mushrooms at growers' farm



Easter lily raised from bulb scale *in vitro* condition

The experiments on *Tagetes minuta* showed that the crop should be harvested at full blooming stage for maximum yield of herbage and oil of acceptable quality. Quality of the oil increased up to full maturity of the crop, after which a drastic reduction (50%) in oil yield was observed.

A lowcost mushroom compost making unit of 60 tonnes/month capacity and involving latest bulk pasturization technique was designed and installed.

The work on computerized world databases on tea and ornamental plants' virus diseases was initiated, and in view of further modernization of charter of the institute, a Biotechnology Division was created.

The 'CSIR Window' division conducted three training programmes in floral art, seven entrepreneurship development programmes (in association with HIMCON) and a general training course in mushroom cultivation. HATS division organized sixteen training programmes on different aspects of tea husbandry; about 310 farmers attended the programmes. Thirteen papers were published/presented during the year.

Physico-chemical studies of Interactions between Biopolyanions and Counterions including Drug Molecules

The native biopolymers are either electrically neutral or charged. Charged biopolymers are either totally anionic like the nucleic acids or may contain both anionic or cationic groups in the same molecule like the natural proteins. Purely cationic biopolymers do not exist in nature. Among the three classes of ionic biopolymers, namely nucleic acids, proteins and anionic polysaccharides, Shri R.C. Yadav of the Indian Institute of Chemical Biology (IICB), Calcutta,chose nucleic acids to probe into the interaction of biopolymers and counterions and heparine, an important and representative member of glycosaminoglycans, to study the distribution of drugs or dyes between two biopolymers. The choice of the counterion was restricted to one acridine dye, namely acridine orange (AO), one cyanine dye, namely pinacyanol (PCYN) and three thiazine dyes, namely thionine (Thl), methylene blue (MB) and 1,9-dimethylmethylene blue (DMMB). The three thiazine dyes were chosen with increasing methyl substitutions. The cationic and intercalating drug daunomycin (DMC) was the sole representative of drugs. The physico-chemical techniques employed included: viscometry conductometry, spectrophotometry and spectropolarimetry. The observations and the inferences made are presented below:

In the metachromatic spectra of t-RNA-AO and DNA-AO system, the maximum blue shift induced by DNA is greater than that induced by t-RNA. This indicates DNA to be slightly stronger chromotrope than t-RNA. In the UV region the band at 284 nm of the dye almost vanishes in presence of both DNA and t-RNA. The molar absorbances of the spectra should have been higher than that of the dye alone owing to the contribution of the absorbance of DNA or t-RNA itself. But, instead, a progressive decrease is observed indicating that the interaction of the dye with the polyanion also affects its electronic transition in the UV region.

Comparison of the CD (circular dichroism) spectra of DNA-AO and t-RNA-AO systems in the UV and visible region indicates that both the nucleic acids induce optical activity in this symmetric dye but in the opposite sense. The chirality of the dye aggregate induced by DNA is opposite to that induced by t-RNA. However, this characterizing difference between the two nucleic acids is not shown by the non-intercalating dye PCYN. Both DNA and t-RNA induce broad and multiple banded metachromasia. The CD spectra of DNA-PCYN system in the visible region have the same sign as that of t-RNA-PCYN. Thus, it can be inferred that the non-intercalating dye PCYN cannot distinguish between the two nucleic acids as in the case of AO.

The geometry of aggregation of a non-intercalating dye is thus not influenced by the inherent inclination of the bases to the respective nucleic acid axis. However, at very high polymer to dye ratio (P/D30), PCYN does discriminate between the two nucleic acids.

Both the nucleic acids induce metachromasia and CD in the three thiazine dyes Thl, MB and DMMB. With all the three thiazine dyes, t-RNA induces CD spectra independent of P/D, unlike the DNA- induced spectra, changing with P/D. DNA thus proves to be stronger chromotrope than t-RNA.

Spectroscopic studies show that heteroaggregation of suitable pairs (AO-MB and AO-DMMB) of dyes is induced by DNA. The formation of heteroaggregation is characterized by the enhancement of the metachromatic band of the partner dye having λ_{max} at relatively shorter wavelength, at the expense of the absorbance at the metachromatic band of the other dye having λ_{max} at a longer wavelength. The CD spectra of the heteroaggregate of pair of dyes (AO-MB) induced by DNA has lower ellipticity values compared to the CD spectra of the individual dye-DNA systems. Thus, though AO and MB form heteroaggregates in presence of DNA, heteroaggregation does not have its reflection in enhancing ellipticity of either of the dye-DNA system. It seems one dye

distrubs the precise geometry of the aggregate of the other, thus [illegible]ering mutually with the induction of dichroism by DNA. Qualitatively similar result is also obtained with the other pair of dye (AO-DMMB). Thus when a pair of dyes forms heteroaggregation in presence of a polyanion, the identity of each dye is maintained; this eventually interferes with the aggregation of the dyes with a geometry predominantly characteristic of either of the dyes.

These results have been utilized for studying the distribution of drug or dye between two biopolymers. When a drug is administered to a living body with the expectation that it would reach the target, the drug may bind to other biomolecules as well, in the environment of the target. The question of competition for a drug between anionic biopolymers, for example DNA and heparin (Hep), arises particularly if the drug is cationic. DNA has two potential modes of binding, namely electrostatic and inner intercalation. Metachromatic and circular dichroic studies of the competition between DNA and Hep for drug [daunomycin (DMC)] and also for a dye (AO) show that DNA robs Hep completely of DMC or AO bound to it. Electrostatic competition does not alone result in such an exchange. DNA robs and hides the drug molecules in its pouches in the form of grooves within its double stranded regions. This is possible because DMC is an intercalating drug.

With a strongly aggregating dye DMMB, it is seen that it has not been an easy job for DNA to snatch all DMMB from Hep, and DNA has to remain only partially satisfied. It is interesting to note that though Hep can resist complete stripping off of its DMMB by DNA, Hep fails completely to snatch any dye from DNA.

Shri Yadav worked under the guidance of Dr M.K. Pal, Professor, Department of Biochemistry & Biophysics, Kalyani University and was awarded Ph.D. degree in Biochemistry (1990) by this university for his thesis based on the above studies.

DEPUTATION BRIEFS

Dr S. Devotta

Dr S. Devotta, Scientist, Chemical Engineering Division, NCL, Pune, was deputed to Mexico from 1 to 8 July 1990 to visit Solar Energy Laboratory, Unam, to participate and deliver a lecture in the Heat Pumps Workshop organized by Institute de Investigaciones Electricas (IIE), Mexico; to USA from 8 to 21 July 1990 to visit Du Pont in Delaware, USEPA in Washington D.C., NIST in Gaithesberg and to attend the International ASHRAECFC Conference at the Purdue University; and finally to UK from 22 to 27 July 1990 to discuss projects related to heat pumps under the Indo-UK MoU projects on heat pumps.

Shri S. Ghosh

Shri S. Ghosh, Scientist, Chemical Engineering Division, NCL, Pune, was deputed to UK for 27 weeks from 29 April 1990 for training in industrial energy audit under the Indo-UK MoU project on Heat Pumps.

Dr A.A. Natu

Dr A.A. Natu, Scientist, Organic Chemistry I Division, NCL, Pune, was deputed to Sweden from 22 June to 6 July 1990 for equipment training in the operation and maintenance of automatic DNA synthesizer GA plus.

Dr A.V. Rao

Dr A.V. Rao, Area Coordinator, Membrane Science and Technology, Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar, was deputed to UK under the British Council-CSIR Exchange of Scientists Programme for two weeks from 30 September 1990.

During his deputation, Dr Rao visited a number of places and held in-depth discussions regarding application of membranes in various processes involving separation, concentration and purification, waste treatment and recovery of reuse of water, effluent treatment and pollution control, besides water desalination. Role of membranes in biotechnology was a topic of mutual interest and discussion.

PERSONNEL NEWS

Appointments/Promotions

At the National Chemical Laboratory (NCL), Pune, Dr V. Ramachandra Rao has been appointed as Scientist EI and Dr S.G. Beri as Medical Officer, with effect from 18 June and 1 June 1990 respectively.

Honours & Awards

Dr K.V.R. Chary

Dr K.V.R. Chary, Scientist, Inorganic & Physical Chemistry Division, Indian Institute of Chemical Technology (IICT), Hyderabad has been conferred on the Young Scientist Award of the Andhra Pradesh Academy of Sciences for the year 1989, in the field of chemistry.

INSA Fellowship for Dr B.D. Kulkarni

Dr B.D. Kulkarni, Scientist, National Chemical Laboratory (NCL), Pune, has been elected Fellow of the Indian National Science Academy (INSA), New Delhi, for the year 1990, in recognition of his

outstanding contributions to the field of Chemical Engineering.

Dr Kulkarni has made significant and original contributions in the area of mathematical modelling of reactions and reactors and in the general area of chemical reaction engineering.

Dr Kulkarni, rated as one of the finest chemical engineers in his age group internationally, is recipient of the INSA Medal for young scientists (1980) and the Amar-Dye-Chem Award for excellence in Research and Development (1981), given annually by the Indian Institute of Chemical Engineers to the young scientists under 35; Herdillia Award for the year 1988 by the Indian Institute of Chemical Engineers, Calcutta, for excellence in basic research in Chemical Engineering and the Shanti Swarup Bhatnagar Award for Engineering and Technology (1988). He is a fellow of Indian Academy of Sciences, Bangalore and National Academy of Engineering.

Prof. H.S. Ray

In recognition of his work in the area of 'High Temperature Reactions and Thermal Chemistry', Prof. H.S. Ray, Director, Regional Research Laboratory, Bhubaneswar, has been elected as the President of the Indian Thermal Analysis Society (ITAS). One of the pioneering scientific bodies, ITAS has been actively engaged in the promotion and growth of thermal analysis in the country for the last one decade. The Society is affiliated to the International Confederation for Thermal Analysis (ICTA). Prof. Ray will take over as the President of the Society in January 1991.

[PATENTS FILED]

688/DEL/90: A two wire analogue current type control signal transmission system for precisely controlling remotely located stepper motors, S.M. Sharma and H. Singh — Central Electronics Engineering Research Institute, Pilani.

689/DEL/90: An improved piston and seal system for stirling engines, S.T. Rajan — Central Salt and Marine Chemicals Research Institute, Bhavnagar.

690/DEL/90: Stereoselective process for the preparation of novel diastereo-isomers of coleonol (forskolin) and related labdane diterpenoids, J.S. Tandon and R.A. Vishwakarma - Central Drug Research Institute, Lucknow.

691/DEL/90: A drinking water filter for the removal of micro-organisms and other pollutants, R.K. Sharma, S. Kumar and P.K. Ray - Industrial Toxicology Research Centre, Lucknow.

692/DEL/90: An improved process for the separation of dihydroxybenzene isomers from aqueous phase using super absorbent polymers, P.P. Moghe, K.M. Gopalkrishna - National Chemical Laboratory, Pune.

693/DEL/90: A process for the preparation of novel crystalline gallosilicates, N.R. Gade, V.P. Shiralkar, A.N. Kotasthane, P. Ratnasamy - National Chemical Laboratory, Pune.

705/DEL/90: A process for the preparation of refractory castables containing 45-50% alumina, A.C. Das, G. Banerjee and S. Kumar - Central Glass & Ceramic Research Institute, Calcutta.

714/DEL/90: A two-step process for production of liquid hydrocarbons from natural gas, V.R. Choudhary, S.D. Sansare and A.M. Rajput - National Chemical Laboratory, Pune.

715/DEL/90: A process for the conversion of ethane to ethylene, V.R. Choudhary and A.M.R. Rajput - National Chemical Laboratory, Pune.

758/DEL/90: A process for the production of low ash, electrically low resistance, strong and dense cathode carbon blocks for aluminium production cell, D.M. Bhat, N.B. Sarkar, S.P. Ghosh, D.S. Chatterjee, A. Sengupta and D. K. Mukherjee - Central Fuel Research Institute, Dhanbad.

759/DEL/90: A process for neutralization of acid coal mine water by spent fluidized bed boiler ash, B.Mazumder and M.M. Bora - Regional Research Laboratory, Jorhat.

760/DEL/90: An improved reactor useful for the preparation of crosslinked macroporous glycidyl copolymers, R.A. Mashelkar, S. Ponrathnam, C.K.M.R. Rajan - National Chemical Laboratory, Pune, and K.K. Krishnadas, G.R. Ambekar, J.G. Shewale, S.R. Naik - Hindustan Antibiotics Ltd.

761/DEL/90: A process for the preparation of a biocatalyst useful for the fermentation of alcohol, T.E. Abraham, J. Rajagopalan, S. Venkataramakrishna and A.D. Damodaran - Regional Research Laboratory, Trivandrum.

762/DEL/90: An improved process for the fermentation of alcohol, J. Rajagopalan, T.E. Abraham, S. Venkataramakrishna and A.D. Damodaran - Regional Research Laboratory, Trivandrum.

763/DEL/90: A device for evaluating electrical contact materials, P.N. Mishra, S.N. Singh, P. Basak, S.C. Dev, A. Roy and O.N. Mohanty - National Metallurgical Laboratory, Jamshedpur.

841/DEL/90: An improved process for the preparation of cumene, A.R. Pradhan and B.S. Rao - National Chemical Laboratory, Pune.

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Flower picking of *Matricaria chamomilla* at the NBRI's Usar Land Reclamation Project farm at Aligarh. A summary of the annual report (1987-88) of the Institute appears on p. 270.

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Significance of Chemisorption Techniques to Study the Dispersion of Active Phases in Supported Oxide and Sulphide Catalysts*

Dr B. MAHIPAL REDDY
Catalysis Section, Indian Institute of Chemical Technology, Hyderabad

The most efficient utilization of any supported catalyst depends on the per cent exposed or the dispersion of the active component on the surface of the support. This dispersion is often controlled by the extent of loading and nature of the active component and the support. The actual state of the active component on the surface of the support depends mainly on the method of preparation, the acidity of the support and the amount of the active component supported. The most commonly used and widely accepted method to determine the dispersion of supported metal catalysts is the selective chemisorption of suitable gases like hydrogen and carbon monoxide. A similar method to determine the dispersion of metal oxides on various supports was not available in the literature until recently. This prompted the IICT scientists to investigate extensively, using the technique of low temperature oxygen chemisorption (LTOC), the dispersion of vanadium oxide, molybdenum oxide/sulphide and tungsten oxide/sulphide on various supports.

OXIDATION CATALYSTS

Vanadium Oxide Catalysts Supported on Alumina

Supported vanadium oxides are industrially important catalysts for the ammoxidation and partial oxidation of hydrocarbons and considerable research activity has been devoted towards understanding the nature of active sites as well as the role played by the carrier. The LTOC technique has been applied for the first time to determine the dispersion of V-oxide phase on Al_2O_3 support surface. The results strongly suggest the formation of a monolayer at about 12 wt% V_2O_5 loading with high degree of dispersion of V-oxide phase on the alumina support [*Appl. Catal.*, 9 (1984) 225]. Beyond the monolayer loading, crystallites of V_2O_5 are formed. The monolayer formation has also been supported by the ESR study carried out at IICT-Hyderabad [*J. Phys. Chem.*, 88 (1984) 2622].

Vanadium Oxide Catalysts Supported on Silica

A series of silica-supported vanadia and molybdenum- and tungsten-promoted vanadia catalysts have been characterized by means of LTOC, ^{1}H MAS NMR, XRD and ESR techniques. Reactivities of these catalysts have also been evaluated for partial oxidation of methanol to formaldehyde. Good correlations have been observed between LTOC capacity and activities of these catalysts. The presence of molybdenum has been found to increase the activity of the catalyst, whereas tungsten has shown the opposite effect. The improved activity of molybdena-vanadia catalyst has been related to the better dispersion of V-oxide phase in the presence of Mo promoter atoms on silica surface [*J. Catal.* 118 (1989) 22].

Similar studies have been carried out for other supports like SnO_2 [*Appl. Catal.*, 56 (1989) 21; *J. Phys. Chem.*, 94 (1990)], Sb_2O_4 (*Catal. Lett.*, submitted) and TiO_2 supports.

HYDROPROCESSING CATALYSTS

Hydrotreating is an important catalytic process for the upgrading of crude oil fractions and coal-derived liquids, and has assumed great significance in recent years, because of the changing economics of oil refining, and growing concern for air pollution. The various hydrotreating processes include hydrodesulphurization (HDS), hydrodeoxygenation (HDO), hydrodenitrogenation (HDN), hydrodemetallization (HDM), hydrogenation (HYD) and hydrocracking. The most commonly used catalysts consist of molybdenum or tungsten promoted with cobalt or nickel supported on a high surface area alumina. The LTOC technique has been applied successfully to provide quantitative information about the dispersion of active phases on various supports.

Alumina Suppported Mo and Co-Mo Catalysts

Low temperature oxygen (-78°C) and hydrogen (300° C) chemisorption have been applied to characterize a series of sulphided Mo/Al and Co-Mo/Al catalysts containing up to 12% Mo. The activities of these catalysts have been evaluated for HDS of thiophene

*Condensed version of the presentation prepared, based on author's own work, for CSIR Young Scientist Award in Chemical Sciences for 1990 [*CSIR News*, 40(1990), 223].

and HYD of cyclohexene. Good correlations have been observed between the HDS or HYD activities and LTOC capacities of these catalysts. This study has clearly demonstrated that the coordinatively unsaturated sites (CUS) are the exact locations for dissociative chemisorption of oxygen, where HDS related reactions also occur. Hydrogen chemisorption results have indicated that hydrogen first dissociates on CUS on the edge planes of MoS_2 prior to its migration to the basel planes where it remains as SH group [*JCS, Faraday Trans I*, 81 (1985) 1655].

Carbon Supported-Mo and Co-Mo Catalysts

Carbon materials have received increased attention as supports for catalytic systems more recently. Potential advantages include low-cost and easy metal recovery by burning off the carbon support. Co-Mo/C catalyst has been found to exhibit exceptionally better activity for HDS of thiophene. The high activity of Co- Mo/C catalyst has been related to the better dispersion of Mo- oxide phase on carbon support determined by LTOC technique [*Appl. Catal.*, 27 (1986) 1].

Similar studies have been carried out for other supports like ZrO_2 [*Polyhedron*, 5 (1986) 191], TiO_2 [*React. Kinet. Catal. Lett.*, 31 (1986) 429] and SiO_2] employing sophisticated techniques like solid state ^1H MAS NMR, ESR, ESCA, XRD, etc. Based on the results, a 'patchy monolayer' model of Mo-oxide phase on various supports has been proposed [*J. Catal.*, 113(1988) 556; *Proc. 9th ICC*, Canada, 1(1988), 82].

AMMOXIDATION CATALYSTS

The ammoxidation of organic substrates containing α-methyl group is an industrially important reaction for the production of fine chemicals. The vapour phase ammoxidation or oxidative ammonolysis of β-picoline in the presence of a suitable vanadium-based catalyst yields nicotinonitrile as the main reaction product. Nicotinonitrile is an important intermediate which can be easily hydrolyzed to nicotinamide or nicotinic acid, both of which are essential for the nutrition of humans and animals.

V_2O_5 α-Al_2O_3 Catalysts derived via Different Precursors

A study has been made to see the effect of precursors on the general dispersion and activity of V_2O_5 catalysts supported on α-Al_2O_3 for the ammoxidation of β- picoline to nicotinonitrile. In this investigation, a series of α-Al_2O_3 supported vanadia catalysts with various V loadings were prepared by the standard wet-impregnation technique with aqueous solutions of ammonium metavanadate (AMV), vanadium oxalate (VOX) and non-aqueous vanadium acetylacetonate (VAA, an organometallic complex) and were characterized by means of LTOC technique. The LTOC and activity results have clearly demonstrated that VAA is the best precursor for the preparation of highly dispersed V-oxide catalysts on α-Al_2O_3 support [*JCS, Chem. Commun.*, 33, 1988].

Mechanism of β-Picoline Ammoxidation

The vapour phase ammoxidation of β-picoline on supported vanadia catalyst generally yields nicotinonitrile as the main reaction product. However, the IICT scientists have observed nicotinamide as the major reaction product on MoO_3 and CuO single oxide catalysts. The following possible mechanisms have been proposed for the selective formation of nicotinonitrile on V_2O_5 and nicotinamide on MoO_3 and CuO oxide catalysts based on ammonia uptake data and by using intermediate products as reactants [*JCS Chem. Commun.*, 940, 1988].

Scheme 1 - PyCN as the major product

$PyCH_3 + NH_3 + (O) \rightarrow PyCH_2NH_2 + H_2O$

$PyCH_2NH_2 + (O) \rightarrow PyCHNH + H_2O$

$PyCHNH + (O) \rightarrow PyCN + H_2O$

Scheme 2 - $PyCONH_2$ as the major product

$PyCH_3 + 2(O) \rightarrow PyCHO + H_2O$

$PyCHO + NH_3 + (O) \rightarrow PyCONH_2 + H_2O$

$PyCONH_2 \rightarrow PyCN + H_2O$

METHANOL SYNTHESIS CATALYSTS

Selective Enhancement of Cu^+ Species

The structure and reactivity of CuO/ZnO and CuO/ZnO/Al_2O_3 catalysts are currently the subject of numerous investigations, especially with respect to methanol synthesis. Monovalent copper in these catalysts has been proposed to be the active centre for the synthesis of methanol from CO and H_2 at low temperatures and pressures. An effort has been made to enhance Cu^+ species selectively *via* a novel nitrous oxide decomposition method. Also the Cu^+ species has been estimated quantitatively by carbon monoxide chemisorption method [*J. Mol. Catal.*, 41 (1988) 17].

Selective Dehydrogenation of Cyclohexanol to Cyclohexanone

Catalytic dehydrogenation of cyclohexanol to cyclohexanone is an industrially important reaction in the manufacture of nylon. Cyclohexanone is also used as a solvent and as a building block in the synthesis of many organic compounds such as pharmaceuticals, insecticides, etc. The catalytic dehydrogenation of cyclohexanol using Cu-MgO and promoted Cu-Al_2O_3 alloy catalysts has gained much importance in recent years. Most of earlier reports show the achievement of about 87% cyclohexanone selectivity at a reac-

tion temperature of 370°C. Under similar conditions the CuO/ZnO/Al_2O_3 catalyst prepared by IICT *via* a novel deposition-precipitation method has shown more than 99% cyclohexanone selectivity. Good correlations have also been observed between Cu^0 species, obtained by physisorption of CO, and cyclohexanone selectivity [*Appl. Catal.*, 45 (1988) 211].

Search for Hydrothermal Metalliferous Sulphides in the South-west Pacific Ocean

The National Institute of Oceanography (NIO), Goa, is collaborating with the Institute of Oceanology, Moscow, USSR, in the 'Study of Geology and Metallogeny of Indian Ocean Ridges and Andaman Back-Arc Basin'. As a part of this programme, two NIO scientists, Drs Ch. M. Rao and A.L. Paropkari, were invited to participate in the submersible cruise on board the USSR Research Vessel *Akademic Mstislav Keldysh* in the south-west Pacific Ocean, so that the Indian scientists could acquaint themselves with the various techniques and submersible operations for the search of hydrothermal deposits.

The vessel had on board two submersibles, i.e. MIR-1 and MIR-2, which had capacity to dive up to a depth of 6000m, provision for three persons [an observer (geologist), a pilot and an engineer] during the dive and an endurance of 22h. The cruise in south-west Pacific comprised three legs and Indian scientists participated in the entire programme. In addition, scientists from Canada, USA, Australia, Kingdom of Tonga and Papua New Guinea (PNG) also participated in the cruise during its different legs. The cruise started from Lae (PNG) on 9 April 1990 and ended at Lorengau (PNG) on 7 June 1990.

During the first leg of the cruise, the Woodlark Basin which falls in the EEZ of PNG, was surveyed. In this leg, 7 submersible dives were conducted. Prior to the dive, a large number of sediment and water samples were collected and analyzed on board, to identify the hydrothermal plumes. During the dives, a number of fresh basalt rock samples were recovered and low hydrothermal activity, as evidenced by shimmering waters and white nontronite (iron rich clay mineral) deposits on basalts, was discovered. During one of the dives on 'Franklin Sea Mount' a chimney was sampled which mainly consisted of baryte with varying amounts of anhydrite and opal. Some of the basalts were covered with fresh glass and had sometimes thin coating of ferro- manganese oxides. The main manganese and iron minerals identified were birnessite and goethite, respectively. Analysis of chimney sample revealed significant concentration of silver (about 500 ppm). The typical hydrothermal fauna was sparse in this region and mainly corals were noticed.

The second leg of the cruise covered EEZ of the Kingdom of Tonga, i.e. Lau Basin. During this leg, water samples and sediment samples were analyzed to locate dive sites, and a total of five dives were undertaken. During the dives, different types of lava (pillow, sheet, etc.) with fresh glass cover were noticed. Major part of the area surveyed showed absence of sediment covers on basalts and at one station, metalliferous sediments were recovered in the core. In addition, a 500 × 500m^2 area covered by inactive field of hydrothermal metalliferous sulphide chimneys was discovered and sampled. They mainly composed of Cu, Zn, and Fe sulphides with accessory amount of opal, baryte and anhydrite. Analysis of these samples revealed up to 54% of Zn, 46% of Cu and 0.17% of arsenic and up to 100 ppm of gold and 100 ppm of silver. An active hydrothermal field was also discovered. The samples collected from this active hydrothermal field were also found to have composition similar to the above. A large nontronite field was also noticed. The hydrothermal fauna was abundant in this region and consisted of gelatheid crabs, worms, shrimps and gastropods.

The third leg of the cruise covered the Manus Basin (EEZ of PNG). During this leg, the water column studies indicated large hydrothermal plumes in the area. Subsequent dives confirmed the existence of a large active hydrothermal system. Active venting and jetting of hot waters were found, which were measured and sampled. The maximum temperature measured in a 'grey' smoker was 275.6°C. Sulphide chimneys of height varying from 2 to 10m were noticed. The chimneys mainly consisted of zinc and copper sulphides with varying amounts of iron sulphides, barytes and opal. The gold and silver contents varied between a few to 100ppm. Arsenic and bismuth contents were found to be significantly high (0.1%). In this basin, the typical hydrothermal fauna was found to be abundant and included gelatheid crabs, worms, shrimps, gastropods, etc. The most typical hydrothermal fauna, i.e. vestimintifera was also observed.

The experience gained by the Indian scientists in this cruise will be very helpful in undertaking similar investigations in the Indian Ocean.

National Workshop on Rural Roads

The Central Road Research Institute (CRRI), New Delhi, organized a National Workshop on Rural Roads, on 15-16 October

1990, under the UN-ESCAP project on Development of Rural Road Infrastructure. The objectives of this project include skill development, transfer of technologies, development of optimum standards for rural roads under different terrain and climatic conditions, and training of personnel in the area of rural roads.

Earlier, CRRI had conducted two international training courses on rural roads under this project — one for rural roads in humid tropics and another for rural roads in arid and semiarid tropics. In these courses about 40 engineers from Afghanistan, Bangladesh, China, Iran, Laos, Mongolia, Sri Lanka, Vietnam and India had participated. Apart from the training of participants, these courses were intended to formulate specific recommendations for participating countries for national-level standards, programmes and policies for rural road development. Accordingly, recommendations for rural road development in the participating countries were evolved during these training courses through group discussions.

The present workshop was organized to discuss and finalize these recommendations on a broader form. To facilitate the discussions, a comprehensive base paper covering the aspects of planning, design, construction, maintenance, organization, management, and technology transfer was prepared. The paper included recommendations of the ESCAP training courses and the recent information available on the above aspects of rural roads. The paper was presented in an introductory session and formed the basis of discussions held during the workshop in four technical sessions : (i) Planning and Policy Issues, (ii) Design and Materials, (iii) Construction and Maintenance and (iv) Organization, Management and Technology Transfer. The recommendations of each of these sessions were presented in the concluding session and finalized.

At the outset, Prof. D.V. Singh, Director, CRRI, welcomed the participants and apprised them about the objectives and methodology of the workshop. The workshop was declared open by Dr A.P. Mitra, Director General, CSIR. About 80 senior level experts from state PWD's, Ministry of Surface Transport, Border Roads Organisation, and other road organizations at the centre and states, universities, research institutions, UNDP, ESCAP, and consultancy organizations participated.

The final recommendations and the proceedings of the workshop would be submitted to the Government of India and to the UN- ESCAP, so that these can be suitably incorporated in the national standards, programmes and policies on rural roads in India and other developing countries in the ESCAP region.

Commercialization of CSIR/NRDC Technologies in Andhra Pradesh: PTC - Hyderabad's Efforts

The Polytechnology Transfer Centre (PTC), Hyderabad, in collaboration with the Andhra Pradesh Industrial Technical Consultancy Organisation (APITCO) carried out a systematic study with a view to preparing strategy for promotion of CSIR/NRDC technologies in the state. For selecting suitable technologies, a screening committee was constituted with representatives from APITCO, PTC, APSFC, IDBI, APSSIDC and COI under the overall guidance of Prof. B.R. Sant, Scientist-in-Charge, PTC-Hyderabad and Shri D. Mallikarjuna Rao, Managing Director, APITCO. The committee identified 22 processes, which seemed to have good potential for commercialization in Andhra Pradesh.

In the second phase of the study, APITCO entered into secrecy agreement with NRDC with regard to each of the identified projects so that it could obtain process details from the research laboratories for preparing pre-investment reports. APITCO and PTC (Hyd) officers visited the laboratories and held discussions with the concerned scientists. As a result, some projects were dropped and some were added. Draft pre-investment reports were prepared and circulated amongst the concerned laboratories and NRDC. Based on the comments received, 16 pre-investment reports were finalized.

In the third phase of the study, APITCO and PTC (Hyd) took up identification of the suitable entrepreneurs for the above 16 projects.

In response to a newspaper advertisement, inviting entrepreneurs to take up the technologies, nearly 120 applications were received. Based on their aptitude, experience and entrepreneurship ability, selection of entrepreneurs was made for 14 projects.

The selected entrepreneurs are now in the process of implementing the project through visits to the laboratories, signing agreements with NRDC, and making the applications with financial institutions.

APITCO and PTC (Hyd) are now evolving a scheme to assist the remaining potential entrepreneurs by suggesting to them alternative projects.

PROGRESS REPORTS

CRRI Annual Report: 1988-89

The Central Road Research Institute (CRRI), New Delhi, carries out its R&D activities in the following sub-disciplines: Geotechnical

Engineering, Soil Stabilization and Rural Roads, Flexible Pavements, Rigid Pavements, Roads, Bridges, Instrumentation, Traffic and Transportation, and Environment and Road Traffic Safety. The significant studies/achievements made by the institute during 1988-89, and covered in its annual report for the period, are mentioned here:

Physico-chemical properties of paving-grade bitumens from different refineries were studied inter alia for asphaltenes, naphthene aromatics and polar aromatics. Their ageing properties were studied by thin film oven test and ultraviolet exposure test. The results indicate that during the process of ageing, naphthene aromatics are converted into polar aromatics which, in turn, are converted into asphaltenes. Further microlevel analysis of different chromatographic fractions by FTIR was being carried out.

The studies on development of anti-oxidants for reducing hardening of bitumens showed that the formation of asphaltenes, polar aromatics, ketenes and carboxylic acid anhydrides can be checked by the addition of metal complexes, ferocene, hycorion and hydrated lime.

Studies in the sub-discipline 'Rigid Pavements' related to: Roller compacted concrete pavements, Joints in RCC pavements, Lime-granulated blast furnace slag (as binder, base course material and as material for paving concrete), Magnesium phosphate cement (for quick repair of concrete), Magnesium oxychloride cement (as a stabilizing agent for soils and their modifications, Superplasticizers (efficacy of indigenous formulations) and durability of lime-soil mixes (capillary moisture and its control).

The institute continued to pursue the project on Pavement Performance Study with a view to developing pavement performance models for Indian conditions. These would supplement the road user cost models developed from the Road User Cost Study in India, completed in 1983, for formulating the total transportation cost models for road transportation in the country. The study comprises two parts: (i) Study of existing pavements sections aimed at expeditious development of preliminary performance models, and (ii) Study of new pavement sections for refinement of the preliminary models.

A test track was completed within the institute premises, with roller-compacted concrete for studying the problems of surface irregularities and joints/cracking. Good progress was recorded in case of the project on construction of rural roads with the agricultural implements and tractors. Based on analyses of data on quality of construction, productivity and cost, the research report was being finalized. The tractor-bound technology intended to facilitate the quality construction of small-size and scattered roads. An ESCAP - sponsored study was completed on the testing of guidelines for remote area transport and socio- economic surveys.

Laboratory and field investigations were undertaken to develop specifications for roads in Khanij Nagar colony of Lambidhar lime stone mine, Mussoarie. Based on the study, specifications were worked out for the roads in the township area, which maximize the use of locally available waste materials, and result in considerable savings both in the cost of construction and consumption of the conventional hardstone. Also, being more labour intensive, these would provide greater employment opportunities.

Work on the evaluation of structural capacity of flexible pavements, based on surface deflection, entered the final phase. So did the study on the experimental sections, using the surface wave propagation technique. The initial results of the Ministry of Surface Transport-sponsored study on axle loads at selected places presented a rather startling picture in regard to the frequency and magnitude of overloading. Such investigations are important for carrying out

Carraige-way and stiffened girder of a suspension bridge

studies related to pavement design, rate of pavement deterioration and reinforcement.

Encouraged by the performance of precast block pavement sections on trial sites in Rajasthan, the institute was trying the alternative method of paving with a mobile crane. A revised design was developed for the flexible element for bullock carts so that the carts with hubs of smaller diameter could also derive the advantages of reduced tractive effort and avoidance of knife- edge loading.

The voluminous data from the transportation planning study for the Bombay Metropolitan region were providing a good store-house for further analyses and researches. During the year, the travel data were studied further for modal split characteristics for the development of disaggregate models. The categorization was done on the basis of socio-economic factors, spatial location and the availability of transport modes. The study sponsored by the Planning Commission on the evaluation of mobility levels was completed. It included transportation problems of various population groups and strategies for transportation planning. Other projects pursued in the area of traffic and transportation were: effect of street-lighting on traffic capacity and accident severity index; refinement and validation of traffic simulation models and their application; and estimation of short-haul urban and sub-urban freight traffic.

An important study completed on traffic safety dealt with the socio-economic background of cyclists and pedestrians involved in road fatalities. The study points to the need for special orientation and other measures for those visiting large urban centres without due awareness about the lurking dangers on city streets. Other investigations on environmental and safety aspects included further development of systems for evaluation of drivers: design of speed breakers, measurement of road traffic noise and exhaust emissions.

In the field of geo-technical engineering, the work was purused on the use of geotextiles/geogrids. Laboratory investigations were carried out on behaviour of a clayey soil with geotextile inclusions, including the swelling characteristics; techno- economic aspects of the use of geotextiles in road construction; and rock-fall control with geogrids. As a follow-up of the laboratory work on stone columns, field experiments were taken up, in collaboration with the Visakhapatnam Port Trust, for improving the bearing capacity of 12-16m thick soft marine clay, to enable it to withstand ore-stacks of 9m height. A computer programme was developed for the design of earth retaining structures with reinforcement.

Laboratory studies were made on the synergistic effect of phosphono carboxylic acid and sodium nitrite as corrosion inhibitor in concrete made of ordinary portland cement. Also, corrosion inhibition effects of zinc-rich organic and inorganic base paints with and without epoxy polyamide top coat, were studied on the reinforcement in concrete beams. Other projects in the 'Bridge' sub-discipline included strengthening of reinforced cement members with externally bonded steel plates, and improvements in expansion joints. In the area of Instrumentation, housing for an LVDT with higher deflection range (± 6.25mm) was designed and fabricated. Work was undertaken on the development of an axle-mounted system for measuring the riding quality of pavements.

The institute organized 16 training courses for the benefit of in-service personnel. ESCAP assigned to the institute major part of the one-million dollar project on training and technology transfer in respect of rural roads.

During the year, 18 papers in different fields of road research were published and about 60 papers were presented in seminars/symposia.

Testing of driver reflexes testing system in progress

NBRI Annual Report: 1987-88

The National Botanical Research Institute (NBRI), Lucknow, during 1987-88, pursued thirty research projects belonging to six reorganized areas of research, viz. Taxonomy and Ethnobotany, Plant Wealth Utilization, Floriculture, Environmental Sciences, Plant Biotechnology and Tree Biology. Eight sponsored/supported research projects were also undertaken; of these, three were sponsored by the Department of Environment, Forests and Wild Life, two each by the Department of Non-conventional Energy Sources, and the Central Council for Research in Unani Medicine, and one by the Department of Science and Technology.

The above information is revealed by the NBRI's annual report for 1987-88. The project-wise R&D achievements of the institute, during the period, are highlighted here:

In the area of Taxonomy and Ethnobotany, under the twin projects on ethnobotanical studies in U.P. and ethnobiological surveys in Madhya Pradesh, surveys were carried out in 15 districts, covering about 100 villages inhabited by nine tribes. An inventory of about 500 plants, used by the tribals, was prepared; 30 samples of plants and plant products were incorporated in the ethnobotanical museum; and five plant samples collected in bulk for phytochemical and biological screening. Further investigations of the *n*-hexane extract of the root stocks of *Euphorbia acaulis* Roxb. yielded minor constituents possessing anti-cancer activity. Under another project, seed development in 13 species, belonging to the family Malvaceae, was studied.

The taxonomic and morphological studies on cryptogams brought to light three lichen species, viz. *Parmentaria anamalaiense* Upreti & Singh; *P. ceylonense* Upreti & Singh and *P. indica* Upreti & Singh, new to science, and six species, viz. *Arthopyrenia nidulans* Mull. Arg., *A. centhocarpoides* Mull. Arg., *Phyllisicum macrosporum* A. Henssen, *Polyblastiopsis guiensis* (Nyl.) Zahlbr., *Parthelium ceyabense* Malme and P. decumbens Mull. Arg., as new records from India.

Based on the studies of Indian pollen flora carried out through an aerobiological survey, conducted under the All India Coordinated Project, a pollen album of allergenic plants was prepared with brief botanical notes on such plants, their pollen descriptions and aerial occurrence of their pollen grains.

In the area of Plant Wealth Utilization, pharmacognostic studies were made on herbal drugs, comprising two species of *Leucas* ('Dronpushpi'), one species of *Coscinium* ('Peetchandan') and 11 species of *Artemisia*.

Investigations on the pest control agents of plant origin revealed that the saponins of *Costus speciosus* Sim., *Momordica charantia* and *Madhuca butyracea* Mc. Bridge inhibited the germination of the ustilospores of *Cintraetia limitata* and *Ustilago scitaminae*. The structure of Soulattrone A, isolated from *Calophyllum soulattri* Burm, last year, was elucidated as a novel C24 terpenoid, occurring rarely in higher group of plants.

The inheritance pattern of papaverine content in *Papaver somniferum* Linn., studied for three generations, indicated that high papaverine plants segregate strongly in the following generation producing a large progeny having lower papaverine content. It was concluded that high papaverine content is due to certain epistatic combination which is broken down in every generation and is produced afresh.

The colouring matter, isolated from *Marchantia palmata* L. yielded five compounds, two of which, namely luteolin 3'-O-B-D-glucuronide and luteolin 7, 3'-di-O-B-D-glucuronide, were found to be new records from Indian liverworts.

For improvement in betelvine cultivation, application of 150 kg N (as 'neem' cake) and 100 kg K_2O per ha, increased the yield of leaves and essential oil, reduced incidence of diseases and improved the keeping quality of leaves.

The work on *Amaranthus hypochondriacus* L. involved F_1 hybrid seed production utilizing the stable temperature dependent male sterile line, evolved earlier. This is the first report of F_1 hybrid seed production involving male sterile line in this crop. A novel distributional pattern of male and female flowers in the inflorescence of *A. caudatus* L., one of the three important grain species of *Amaranthus* cultivated in India, was discovered in which the lower 7-10 glomerules are entirely female, while the terminal ones are normal. This type of inflorescence, a new record for the genus, offers possibilities of using female parent to raise F_1 hybrids by nipping of the terminal part of the spike.

Under a specially funded project on 'Usar Land Reclamation at Aligarh', 17 q/ha wheat, 1.5 q/ha berseem, and 24.7 q/ha paddy were produced. About 50,000 saplings of fast growing firewood trees were also planted, besides extending the cultivation of German chamomile, in 5.5 ha.

In the Central Herb Garden and Museum of the CCRUM Unit, about 50 annual herbs were planted and 160 perennial medicinal plants were maintained; and 250 drug samples and 1,000 herbarium specimens were incorporated. About 100 kg 'Atrilal' (*Ammi majus* L.), 50 kg 'Gule-Babunah' (*Matricaria chamomilla* L.) and 18

kg 'Gulnar Farsi' (*Punica granatum* L.) were supplied to different units of the CCRUM. In the Drug Standardization Unit, five compound drugs were standardized and pharmacognostic studies were carried out on four single drugs.

In the area of Floriculture, the new cultivars evolved and released by the institute, for the nursery trade were: 'Basant Bahar', 'Menaka' and 'Kajal' of *Gladiolus*; 'Pallavi' — a gamma ray induced mutant of *Bougainvillea* cv. 'Roseville's Delight'; 'Agnishikha' — a gamma ray induced mutant of *Chrysanthemum* cv. 'D-5'; 'Alipor Beauty' — a single flower type mutant of *Hibiscus*; and 'Poonam' and 'Deepali' — two hybrids of Hippeastrum. Tissue culture raised *Rosa hybrida* Hort. 'Superstar' plants survived 50% on their own root systems and produced flowers true-to-type, 1.5 cm. in diameter. A complete package for micropropagation of this cultivar was standarized. More than 150 *in vitro* raised normal plants of *Peperomia obtusifolia* A. Dietr. and 50 plants of the variegated cultivar were grown successfully in soil under glass house conditions. Eleven exotic flowering annuals were also introduced for their ornamental value.

In the area of Environmental Sciences, experimental studies carried out on *Vinca rosea* L. and *Tabernaemontana* Willd. showed that plants of both the species are tolerant to emissions of thermal power stations. Likewise, plants of *Holoptelea integrifolia* L., *Morus alba* L. and *Lantana indica* Roxb. were found to be tolerant to SO_2 and fly ash pollution. The studies carried out on aquatic plants in relation to industrial effluents of Kalyani Devi pond in Unnao district revealed that the concentration of chromium (0.05 ppm) was at critical level, while the manganese concentration (0.18 ppm) was higher. The maximum uptake of heavy metals in terms of μ g/g dry wt. was: copper (124.75) by *Spirodela polyrrhiza* (L.) Scheid; cadmium (12.5) by *Eichhornia crassipes* (Mart.) Solms.; chromium (62.5) by *Ceratophyllum demersem* L.; iron (15917.0) by *Hydrodictyon reticulatum* (L.) Lagerhein; manganese (2065.0) by *C. demersum* and lead (71.25) by *H. reticulatum*.

'Agnisikha' — a new γ-ray induced mutant of chrysanthemum

In the area of Plant Biotechnology, biochemical and biophysical studies of the process of photosynthesis and nitrogen metabolism in plants revealed that lysine sensitive isoenzyme of aspartate kinase possessed calmodulin as its subunit. This is the first example of a plant enzyme that has calmodulin as one of its sub-units. A method for the preparation of Photosystem II particles, almost free from Photosystem I contamination, was standardized.

The studies made on physiology and genetic regulation of heterocyst differentiation in Cyanophyceae brought about isolation and characterization of two classes of NTG-induced rifampicin-resistant strains of *Nostoc muscorum* Ag. showing that *rif* locus is associated in close proximity of regulatory gene(s) of *het* and *nif* systems. Kinetics of ammonia assimilation in N_2 fixing cultures showed a biphasic pattern of uptake under photoautotrophic conditions.

Biochemical and immunological studies on plant viruses were continued and a tombusvirus affecting egg plant was isolated and identified as an Indian strain of egg plant mottled crinkle virus (EMCV-I). Dot immunobinding assay technique was standardized for detection of chrysanthemum virus B.

Under the project Tissue Culture of Economic Plants, more than 100 *in vitro* raised plants of clone 'G-48' of *Populus deltoides* Marsh were successfully grown in soil under glass house conditions and 50 of these were also transplanted in the field. Microtuberization of

Solanum tuberosum L. proliferating shoots could be enhanced to about 15 microtubers in some cultures. These microtubers, when sown in soil, sprouted within 15-20 days producing normal plants capable of producing tubers. A procedure for polyacrylamide gel electrophoresis of proteins associated with different stages of shoot bud differentiation was standardized.

In the area of Tree Biology, 11 selected species were evaluated, for biomass production potential in alkali soils. *Prosopis juliflora* (Siv.) DC. showed best performance for the fifth year with respect to its mean annual increment and current annual production. In wood characteristics too, the species was found to be the best as evidenced by its low moisture content (27.6%), high density (0.8 g/cc) and relatively good calorific value. For herbaceous biomass, sugarbeet var. Ramonskaya-06 was found to be the best for its good yield (33.6 t/ha) and high sugar content (19.4%).

Physiological studies for production of woody biomass by three species, namely, *Acacia auriculaeformis* A. Cunn., *Dalbergia sissoo* Roxb. and *Terminalia arjuna* (Roxb.) W. & A. indicated maximum rate of photosynthesis in April and the lowest in June, with an optimum growth at a temperature range 35 - 37°C. On the basis of wood characteristics worked out for 40 potential fuelwood species, 7 of these were recommended as fuelwood species because of comparatively good quality of their fuelwoods.

Studies carried out on Indian soft-wood conifers indicated that *Pinus patula* Scied & Deppe and *Cupressus arizonica* Greene were fast growing and fertile species for which seed orchards can be raised with effective regeneration.

During the year, 121 papers were published, and 42 papers were presented at various symposia/seminars.

TRAINING COURSES

CIMAP Training Programme on Agro-techniques for Non-traditional Crops

The Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, organized a training programme, third in the series of 'Training of Trainers', at Bakewar, Etawah, U.P., during 17-19 August 1990. These training programmes were aimed at acquainting the growers with the agro-techniques of non-traditional crops to make full use of the fields which are not suitable for traditional crops like wheat, rice, pulses, sugarcane, etc. They were also intended to make the growers aware of the benefits of growing these crops when there are no conventional crops in the field.

More than 120 persons including farmers, distillers, end users of essential oils, teachers and students and government officials attended the third training programme. Lectures were delivered by the CIMAP scientists on: citronella, lemongrass, palmarosa, khus and various species of mint. Agro-techniques discussed included cultivation of oil-bearing plants, and distillation of essential oils. A field distillation unit was installed in the campus and process for oil extraction from plants was demonstrated.

One of the sessions was devoted to marketing of the plant products. Also highlighted were the facilities extended by CIMAP to the growers, e.g. distribution of plant material, transfer of technical know-how, installation of distillation units, quality evaluation of oil and marketing of the products.

Earlier, in his opening remarks, Shri O.P. Virmani, Deputy Director, CIMAP, highlighted the objectives of such training programmes and mentioned the facilities available at the institute. He also gave a lecture on : Medicinal and Aromatic Plants of Commercial Value.

Presiding over the valedictory function, Shri Rajiv Kapoor, IAS, Chief Development Officer of Etawah District, appreciated the

Trainers who attended the 'Training of Trainers' programme at Etawah, are being explained the working of distillation unit for extraction of essential oils

efforts of CIMAP towards popularizing essential oil-bearing plants in the district. He assured that land would be made available for cultivating crops like lemongrass, palmarosa and khus which are quite suitable for wastelands.

Prof. S.K. Mitra Birth Centenary Issue of IJRSP

The October-December 1990 issue of the *Indian Journal of Radio & Space Physics* has been brought out as 'Prof. S.K. Mitra Birth Centenary' issue. Prof. Mitra was the pioneer in the areas of upper atmospheric physics and radio science in India and his contributions have been acclaimed internationally.

Guest edited by Dr A.P. Mitra, F.R.S. and Dr B.S. Mathur, F.N.A.Sc., the issue contains 28 papers ranging from quantum metrology and fundamental constants to giant metrewave radio telescope. There are papers on global compunication, multimetre wave gyrotron, signal processing and semiconductor and superconductor devices — areas in which Prof. S.K. Mitra had done his earlier work, and on ionosphere: ionospheric modelling, equatorial ionosphere, solar-terrestrial physics, satellite beacon studies and a comparative study of Venus and Mars (upper atmospheres, ionospheres and solar wind interactions) a field in which he had done initial and original research in India. Some papers are on radars, remote sensing, Indian troposphere in relation to communication, artificial satellites, and also on solar wind, solar eclipse and ozone studies. One paper is on radio physics and electronics education.

The issue (pp 308, price Rs100, £22, $34) can be obtained from: the Senior Sales & Distribution Officer, Publications & Information Directorate, Hillside Road, New Delhi 110012.

CONFERENCE BRIEFS

Gordon Research Conference in Communications and Control in Complex Systems

Dr Somdatta Sinha, Scientist, Centre for Cellular and Molecular Biology, Calcutta, attended the Gordon Research Conference in Communications and Control in Complex Systems, held at the Tilton School, New Hampshire, during 2-6 July 1990. The main objective of the conference was to discuss and understand the underlying nature of complex systems (biological, physical, sociological, philosophical and artificial) from their diverse functional and structural manifestations.

Dr Sinha presented a paper on Mathematical Modelling of Biochemical Reactions in Cells. His work based on existing experimental data predicted that such reaction systems can operate in a variety of dynamical regimes, such as stable, bistable, oscillatory, oscillations with period bifurcations and chaotic. These reaction systems are regulated by feedback loops and are quite common in biochemical reactions.

DEPUTATION BRIEFS

Prof. S.K. Rangarajan

Prof. S.K. Rangarajan, Director, Central Electrochemical Research Institute (CECRI), Karaikudi, visited Czechoslovakia, for two weeks from 14 August 90, under the Exchange of Scientists Programme between the Indian National Science Academy, New Delhi, and the Czechoslovakian Academy of Sciences, Prague. During his visit he participated in the Workshop on Electrochemical Approaches in Molecular Biology held in Brno during 15-18 August 90 and delivered a talk 'Ion Transport Across Membranes — A Fluctuation Analysis'. He also participated in the J. Heyrovsky Centennial Congress on Polarography, organized alongwith the 41st Meeting of the International Society of Electrochemistry in Prague during 20-25 August 90 and delivered a talk on 'Some Model Stochastic Processes in Noise and Crystallization'.

Prof. S.K. Rangarajan also attended the Third General Conference of the Third World Academy of Sciences (TWAS) held at Caracas, Venezuela, during 15-19 October.

Shri S. Dheenadayalan

Shri S. Dheenadayalan, Scientist, CECRI, visited Czechoslovakia for six weeks during August - September 1990 under the Programme of Cooperation on Science and Technology between the CSIR, New Delhi and the Czechoslovakian Academy of Sciences, Prague. During his stay, he visited the Institute of Inorganic Chemistry, Prague; and the J. Heyrovsky Institute of Polarography, Prague.

He also attended the 41st ISE Meeting held in Prague during 20-25 August 90. During his visit, he had fruitful interactions on the research and development of the fuel cells.

Honours & Awards

Dr G.P. Phondke

Dr G.P. Phondke, Director, Publications & Information Directorate, New Delhi, has been given the Maharashtra State Award for excellence in literature in the category 'Science Fiction' for his book 'Chiranjeeva' which is a collection of science fiction stories in Marathi. This is an annual award

given by the Government of Maharashtra

Shri P.K. Srivastava

Shri Pradeep K Srivastava, Technical Officer, Central Drug Research Institute (CDRI), Lucknow, received 'The Outstanding Young Person of The World' award in the field of academic leadership and accomplishments, on 13 November 1990, in Puerto Rico (USA) This award is given annually by Junior Chamber International (USA), to 10 persons in various fields

Shri Srivastava was also given a fully sponsored visit to USA A prominent publishing company has offered him to publish his scientoons

Earlier, Shri Srivastava was given the 'Outstanding Young Person of India' award by the Indian Junior Chamber, for excellence in the field of science [*CSIR News*, 40(1990), 151]

Dr S.B. Mahato

The American Biographical Institute (ABI), Inc , USA, has, announced the nomination of Dr S B Mahato, Scientist, Indian Institute of Chemical Biology, Calcutta, for the prestigious title Man of the Year - 1990, in recognition of his overall accomplishments and contributions to science The International Board of Research of ABI, after much deliberation, chose the name of Dr Mahato whose achievements and dedication towards exemplary goals were adjudged to be the best among the list of recongized who's who titles

ABI, a publisher of biographical reference works and a member of the Association of American Publishers, Inc. would commemorate the occasion with an accolade.

PATENTS FILED

403/DEL/90: An improved process for the manufacture of 2-arylalkenoic acids, D.S. Iyengar, U.T. Bhalerao and N. Lalitha — Indian Institute of Chemical Technology, Hyderabad.

530/DEL/90 An improved process for the recovery of silver from colour bleach fix solution N Sathaiyan, J A A M A Kader, P M Adaikkalam and S I Visvanathan — Central Electrochemical Research Institute, Karaikudi

618/DEL/90 A process for the preparation of soft board material from lignocellulosic material and polymer Navin Chand S A R Hashmi and T C Rao — Regional Research Laboratory, Bhopal

619/DEL/90 A portable water analysis kit for physico-chemical and bacteriological analysis of drinking water sources P K Ray P K Seth, H Chandra, V K Sehgal R K Sharma, V P Sharma, R Gopal, S Kumar, R K Srivastava, S P Pathak, P W Ramteke, Mohd M Qureshi and J W Bhattacharjee — Industrial Toxicology Research Centre, Lucknow

622/DEL/90 A process for the hydrometallurgical extraction of copper from sulphide ores using silver ion as catalyst, P C Bandyopadhyay — Indian Institute of Chemical Biology, Calcutta

ANNOUNCEMENTS

International Symposium on Fatigue and Fracture in Steel and Concrete Structures

An International Symposium on Fatigue and Fracture in Steel and Concrete Structures organized by the Structural Engineering Research Centre (SERC), Madras, will be held during 19-21 December 1991 The main objectives of the symposium are to review the latest advances in the field of fatigue and fracture pertaining to steel and concrete structures and provide an international forum for scientists, engineers, academicians, designers and researchers in these areas to exchange ideas and to promote a better understanding through technological cooperations. State-of-the-art reports in these fields will be presented by experts from R and D institutions, universities and industry.

For further details please write to Dr A G. Madhava Rao, Organizing Secretary and Deputy Director - ISFF-91, SERC, CSIR Campus, Taramani, Madras 600113.

Workshop on Science Writing in Hindi for Mass Media

The Publications & Information Directorate (PID), New Delhi, is organizing a Workshop on Science Writing in Hindi for Mass Media, in collaboration with the Central Institute of Indian Languages, Mysore, during 18-23 February 1991

The main objective of the workshop is to familiarize the participants with the methods of science writing for the various mass media such as newspapers, popular science magazines, radio and television

The proposed topics for the workshop are

1 Science and Society· Role of Science in the Removal of Superstition
2 Technology Missions: Drinking Water, Oil Seeds and Wasteland
3 Public Health. Vaccines, Adulterated/Harmful Medicines, and AIDS
4. Environment: Ozone Depletion, Green House Effect, Toxic Effects of Insecticides
5. Nobel Prizes for 1990 in Medical Sciences, Physics and Chemistry
6. Human Genome Programme
7. Interviews with Scientists on Their S&T Achievements
8. Others: Subjects of participants interest.

Further details regarding the workshop can be had from: Shri T.P. Pathak, Workshop Coordinator, PID, Hillside Road, New Delhi 110012.

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